Vol. 9, No. 11
June 15, 1984

Energy Research Abstracts

Abstracts 19604-21643

Technical Information Center
Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB84-901000**

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***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

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Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

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Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information, Technical Information Center (TIC) cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Office of Scientific and Technical Information, Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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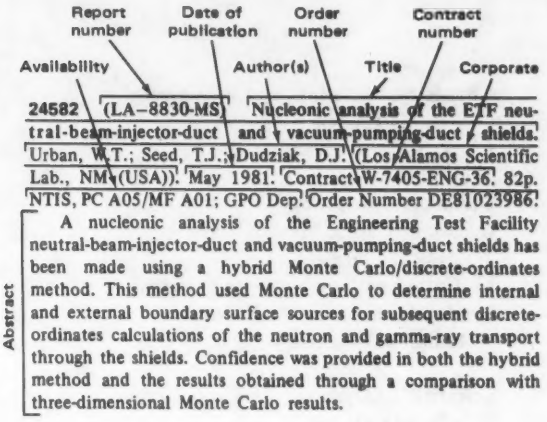
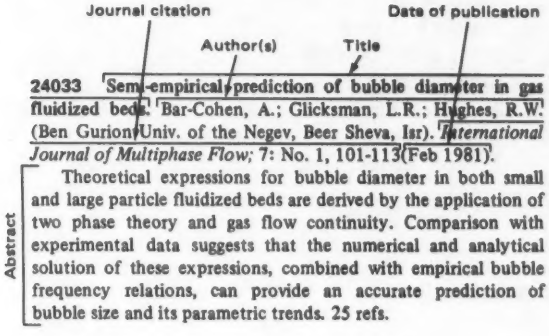
HOW TO USE *ENERGY RESEARCH ABSTRACTS*

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Order number
Contract number
Availability
Author(s)
Title
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE81023986.
Abstract
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr.). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Abstract
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
Neutral Atom Beam Injection
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Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
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• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

LA–		
8830-MS	**6:24582**	**NTIS, PC A05/MF A01; GPO Dep. Order Number DE81023986, Distribution Category STD-20d**

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

19604 **(NMERDI—2-71-4638) Program planning: advanced coal technologies. Final report.** Hammesfahr, F.W. (Hammesfahr-Winter and Associates, Inc., Bernardsville, NJ (USA)). Mar 1984. 42p. New Mexico Energy Research and Development Institute Information Center, Univ. of New Mexico, 457 Washington, SE, Suite M, Albuquerque, NM 87108.

This contract that has as its primary objective the identification of coal-related technology areas that: 1. support already chosen NMERDI priority coal research and development programs and 2. have potential for: a. near-term pilot scale activity that could be sited in New Mexico, b. commercialization in New Mexico within a reasonable time frame, and c. participation by and funding support from industrial, governmental and/or trade association sources. Coal cleaning, underground coal gasification, surface coal gasification, coal liquefaction, methanation, and coal fly ash processing were reviewed through multiple contacts with leading coal process R and D organizations. From this, coal cleaning is recommended as an area offering close fit to NMERDI's objectives and funding potentials. Monitoring of underground coal gasification, methanation, and fly ash processing is also recommended for the possibility that identified reasonably near-term developments may create NMERDI program opportunities.

0104 Processing

REFER ALSO TO CITATION(S) 19636, 19640, 19648, 19657, 19659, 19883, 19886, 20454

19605 **(ANL/FE—83-18) Preliminary report on development of nonintrusive flow instrumentation at the ANL Solid-Liquid Test Facility.** Bobis, J.P.; Sheen, S.H.; Porges, K.G.A.; Karplus, H.B.; Farahat, M.M.; Brewer, W.E.; O'Fallon, N.M.; Raptis, A.C. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 138p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84009135.

Commercially available flowmeters, mostly of the intrusive type, have not performed well in measuring mass flow in solid/liquid media found in coal gasification plants. Argonne National Laboratory is examining or developing a number of nonintrusive flowmeters for coal gasification slurries. The performance of four nonintrusive flow instruments is assessed in a coal-oil slurry at the ANL Solid-Liquid Test Facility (SLTF). The slurry mass flow rate is determined from individual measurements of the slurry density and velocity over a range of slurry velocities from 0.4 to 3.7 m/s and coal concentrations from 0 to 60 wt %. The density and velocity are measured by the capacitive and acoustic cross-correlation flowmeters while the slurry velocity only is measured by the acoustic Doppler and gamma transmission flowmeters. For the series of flow tests, the four flowmeter systems produced quantitative information for flow regimes that ranges from Newtonian at low coal concentrations to strongly non-Newtonian at high coal concentrations. The readout of all flow instruments is compared with the independent measurements of the slurry density, velocity, and solid concentration from the SLTF 1% timed weight/volume diversion system, grab-sample evaluations, and the on-line Pulsed Neutron Activation system. The results are discussed in terms of theoretical models which verify the observed velocity dependence for each flowmetering system on the flow regime and flow sensor-specific geometry. Based on this preliminary work, improved data processing schemes and sensor geometry optimization will be sought, with the goal of developing a family of accurate nonintrusive flowmetering systems that are substantial free from readout errors over the range of flow regimes encountered in industrial coal slurry systems. 65 references, 50 figures, 10 tables.

19606 **(ANL/FE—83-26) Analysis of failed superheater tubing from the Mountain Fuel Resources Coal Gasification PDU.** Diercks, D.R. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009116.

A sample of failed superheater tubing from the Mountain Fuel Resources Coal Gasification PDU has been analyzed. The sample consisted of a length of 1-1/4 in. Schedule 80 Incoloy 800H pipe circumferentially cracked near a weld to an adjacent 2-1/4Cr-1Mo steel elbow. The failure was attributed to intergranular stress corrosion cracking of the sensitized Incoloy 800H near the weld. The corrosive species responsible for the failure were water-soluble chlorides and sulfates present in the soot and ash deposit on the outside of the tubing. The necessary tensile stresses were provided by the residual stresses present in the region of the dissimilar-metal weld. The results of the failure analyses indicate that further failures of this type can be prevented by avoiding condensation at the outer surface of the superheater, particularly during plant startup. This could be accomplished either by maintaining the superheater at temperatures above about 72°C (162°F) during startup or by venting the wet combustion product gases produced during startup before they reach the waste heat recovery system. 12 references, 10 figures, 1 table.

19607 **(CONF-840577—2) Multizone ultrasonic thermometry with application to coal gasification systems.** Gopalsami, N.; Raptis, A.C. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31109-ENG-38. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006450.

From 30. international instrumentation symposium; Denver, CO, USA (7 May 1984).

The decrease of sound velocity with temperature in solid media is utilized in ultrasonic thermometry. A multizone sensor generally consists of a thin rod on which small notches are made to partition the sensor length into various zones. The change of acoustic impedance at the notches causes the sound waves to be partly reflected back, and the measurement of time intervals between the successive pairs of reflected signals provides an indication of the average temperatures in the corresponding zones. This paper addresses the application of ultrasonic senses to temperature profiling in the reactors of coal gasification systems. In particular, results on the sensor development, materials testing, and signal processing are presented. 14 references, 8 figures, 1 table.

19608 **(DOE/ET/10069—T87) EDS coal liquefaction process development, Phase V. Engineering design study of an EDS Illinois bottoms fired hybrid boiler.** (Combustion Engineering, Inc., Windsor, CT (USA)). Apr 1984. Contract FC05-77ET10069. 114p. (FE—2893-113). NTIS (US Sales Only), PC A06/MF A01; 1; GPO Dep. Order Number DE84010251.

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This interim report documents work carried out by Combustion Engineering, Inc. under a contract to Exxon Research and Engineering Company and was prepared by Combustion Engineering, Inc. This report is the second of two reports by Combustion Engineering, Inc. on the predevelopment phase of the Hybrid Boiler program and covers the results of an engineering design study of a Hybrid Boiler firing the vacuum distillation residue (vacuum bottoms) derived from processing Illinois No. 6 coal in the EDS Coal Liquefaction Process. The function of the Hybrid Boiler is to heat the coal slurry feed for an EDS coal liquefaction plant by a process

coil in the convection section and to generate high pressure steam in the radiant section. The Hybrid Boiler design developed in this phase of the program is based on the results of a laboratory characterization program (reported in EDS Interim Report FE-2893-112), on Combustion Engineering, Inc.'s extensive experience as a designer and supplier of steam generating equipment, and on Exxon Research and Engineering Co.'s experience with the design and operation of process heaters.

19609 **(DOE/ET/10159—1552) Low-Btu coal gasification in the United States: company topical.** Boesch, L.P.; Hylton, B.G.; Bhatt, C.S. (UOP, Inc., Des Plaines, IL (USA); System Development Corp., Santa Monica, CA (USA)). Jul 1983. Contract AC01-78ET10159. 244p. NTIS, PC A11/MF A01; GPO Dep. Order Number DE84003066.

Hazelton and other brick producers have proved the reliability of the commercial size Wellman-Galusha gasifier. For this energy intensive business, gas cost is the major portion of the product cost. Costs required Webster/Hazelton to go back to the old, reliable alternative energy of low Btu gasification when the natural gas supply started to be curtailed and prices escalated. Although anthracite coal prices have skyrocketed from $34/ton (1979) to over $71.50/ton (1981) because of high demand (local as well as export) and rising labor costs, the delivered natural gas cost, which reached $3.90 to 4.20/million Btu in the Hazelton area during 1981, has allowed the producer gas from the gasifier at Webster Brick to remain competitive. The low Btu gas cost (at the escalated coal price) is estimated to be $4/million Btu. In addition to producing gas that is cost competitive with natural gas at the Webster Brick Hazelton plant, Webster has the security of knowing that its gas supply will be constant. Improvements in brick business and projected deregulation of the natural gas price may yield additional, attractive cost benefits to Webster Brick through the use of low Btu gas from these gasifiers. Also, use of hot raw gas (that requires no tar or sulfur removal) keeps the overall process efficiency high. 25 references, 47 figures, 14 tables.

19610 **(DOE/MC/16518—1476) Prediction and measurement of entrained flow coal gasification processes. Interim report, September 8, 1981-September 7, 1983.** Hedman, P.O.; Smoot, L.D.; Fletcher, T.H.; Smith, P.J.; Blackham, A.U. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 31 Jan 1984. Contract AC21-81MC16518. 217p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84008275.

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This volume reports interim experimental and theoretical results of the first two years of a three year study of entrained coal gasification with steam and oxygen. The gasifier facility and testing methods were revised and improved. The gasifier was also modified for high pressure operation. Six successful check-out tests at elevated pressure were performed (55, 75, 100, 130, 170, and 215 psig), and 8 successful mapping tests were performed with the Utah bituminous coal at an elevated pressure of 137.5 psig. Also, mapping tests were performed at atmospheric pressure with a Utah bituminous coal (9 tests) and with a Wyoming subbituminous coal (14 tests). The LDV system was used on the cold-flow facility to make additional nonreactive jets mixing measurements (local mean and turbulent velocity) that could be used to help validate the two-dimensional code. The previously completed two-dimensional entrained coal gasification code, PCGC-2, was evaluated through rigorous comparison with cold-flow, pulverized coal combustion, and entrained coal gasification data. Data from this laboratory were primarily used but data from other laboratories were used when available. A complete set of the data used has been compiled into a Data Book which is included as a supplemental volume of this interim report. A revised user's manual for the two-dimensional code has been prepared and is also included as a part of this interim report. Three technical papers based on the results of this study were published or prepared. 107 references, 57 figures, 35 tables.

19611 **(DOE/MC/19077—1532) Hot gas cleanup using solid supported molten salt for integrated coal gasification/molten carbonate fuel cell power plants. Topical report, October 1982-December 1983.** Lyke, S.E.; Sealock, L.J. Jr.; Roberts, G.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC21-82MC19077. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84003067.

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Battelle, Pacific Northwest Laboratories is developing a solid supported molten salt (SSMS) hot gas cleanup process for integrated coal gasification/molten carbonate fuel cell (MCFC) power plants. Exploratory and demonstration experiments have been completed to select a salt composition and evaluate its potential for simultaneous hydrogen sulfide (H_2S) and hydrogen chloride (HCl) removal under the conditions projected for the MCFC plants. Results to date indicate that equilibrium capacity and removal efficiencies may be adequate for one step H_2S and HCl removal. Regeneration produced a lower H_2S concentration than expected, but one from which sulfur could be recovered. Bench scale experiments will be designed to confirm laboratory results, check carbonyl sulfide removal, refine dual cycle (sulfide-chloride) regeneration techniques and obtain data for engineering/economic evaluation and scale-up. 8 references, 24 figures, 7 tables.

19612 **(DOE/METC—84-7) Proceedings of the ninth annual underground coal gasification symposium.** Wieber, P.R.; Martin, J.W.; Byrer, C.W. (eds.). (USDOE Morgantown Energy Technology Center, WV). Dec 1983. 571p. (CONF-830827—). NTIS, PC A24/MF A01; 1; GPO Dep. Order Number DE84003052.

From 9. annual symposium on underground coal gasification; Bloomingdale, IL, USA (7 Aug 1983).

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The Ninth Underground Coal Gasification Symposium was held August 7 to 10, 1983 at the Indian Lakes Resort and Conference Center in Bloomingdale, Illinois. Over one-hundred attendees from industry, academia, National Laboratories, State Government, and the US Government participated in the exchange of ideas, results and future research plans. Representatives from six countries including France, Belgium, United Kingdom, The Netherlands, West Germany, and Brazil also participated by presenting papers. Fifty papers were presented and discussed in four formal sessions and two informal poster sessions. The presentations described current and future field testing plans, interpretation of field test data, environmental research, laboratory studies, modeling, and economics. All papers were processed for inclusion in the Energy Data Base.

19613 **(DOE/METC—84-8) Advanced gasification projects. Third annual contractors' meeting proceedings.** Ghate, M.R. (ed.). (USDOE Morgantown Energy Technology Center, WV). Nov 1983. 422p. (CONF-830641—). NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84000217.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

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On June 28-30, 1983, METC sponsored the Third Annual Advanced Gasification Projects Contractors' Meeting, which was held at Sheraton Lakeview, Morgantown, West Virginia. The purpose of the meeting was threefold: to review the technical progress and current status of DOE's advanced gasification projects; to foster technology exchange among participating researchers; to facilitate interactive dialogues that would identify research needs and aid in planning future advanced gasification research activities. Fifty representatives of government, academia, and industry attended the three-day meeting. Forty-one papers were presented summarizing recent developments in fundamental mechanisms/innovative concepts, modeling, and gas cleanup/waste-water treatment. Scientists, engineers, and administrators discussed many of today's issues that face those engaged in the research and development activities that constitute the advanced gasification program. All papers in this proceeding were processed for inclusion in the Energy Data Base.

19614 (DOE/OR/03054—21) Internal R & D task summary report: analytical methods development. Schweighardt, F.K. (International Coal Refining Co., Allentown, PA (USA)). Jul 1983. Contract AC05-78OR03054. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009919.

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International Coal Refining Company (ICRC) conducted two research programs to develop analytical procedures for characterizing the feed, intermediates,and products of the proposed SRC-I Demonstration Plant. The major conclusion is that standard analytical methods must be defined and assigned statistical error limits of precision and reproducibility early in development. Comparing all SRC-I data or data from different processes is complex and expensive if common data correlation procedures are not followed. ICRC recommends that processes be audited analytically and statistical analyses generated as quickly as possible, in order to quantify process-dependent and -independent variables. 16 references, 10 figures, 20 tables.

19615 (DOE/OR/03054—85) Aquifer characterization proposed SRC-I facility, Newman, Kentucky. (International Coal Refining Co., Allentown, PA (USA)). 1984. Contract AC05-78OR03054. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84010110.

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Dames and Moore conducted a two-phase groundwater supply and aquifer characterization study on a portion of the proposed Solvent-Refined Coal (SRC-I) Demonstration Plant site at Newman, Kentucky. The objectives were to assess the transmissivity, hydraulic conductivity, and storability of the aquifer in the vicinity of the test well, and to determine the aquifer characteristics beneath the proposed facility.

19616 (DOE/OR/03054—86) Environmental monitoring final report: groundwater chemical analyses. (Dames and Moore, Lexington, KY (USA)). Feb 1984. Contract AC05-78OR03054. 125p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84009435.

This report presents the results of analyses of groundwater qualtiy at the SRC-I Demonstration Plant site in Newman, Kentucky. Samples were obtained from a network of 23 groundwater observation wells installed during previous studies. The groundwater was well within US EPA Interim Primary Drinking Water Standards for trace metals, radioactivity, and pesticides, but exceeded the standard for coliform bacteria. Several US EPA Secondary Drinking Water Standards were exceeded, namely, manganese, color, iron, and total dissolved solids. Based on the results, Dames & Moore recommend that all wells should be sterilized and those wells built in 1980 should be redeveloped. 1 figure, 6 tables.

19617 (DOE/PC/40812—T10) New catalysts for coal liquid upgrading. Quarterly report, December 1, 1983-29 February 1984. Boucher, L.J. (Western Kentucky Univ., Bowling Green (USA). Dept. of Chemistry). 1984. Contract FG22-81PC40812. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008311.

The objective of this project is to develop thermally stable, poison-tolerant catalysts that will be effective under moderate conditions in the hydrogenation or hydrodenitrogenation of nitrogen-containing heterocycles typical of coal liquids. The hydrogenation of model compounds, model compound mixtures and coal liquids will be carried out using the new class of catalysts, metallophthalocyanines [M(PC)]. Work completed in this quarter centered on the effect of the modification of the reactor configuration on the reaction rate in the catalytic hydrogenation of quinoline. The kinetic work done previously in this project on supported Cobalt Phthalocyanine Catalysts utilized a 300 cc Autoclave Engineers Reactor. The catalysts recovered from the reaction mixture after 7 hours were subjected to cobalt analysis. The results are summarized in tabular form. The data clearly shows that no metal is lost from the catalysts used in the reactor with the baffle-new impeller configuration as well as with the baffle-dual propeller configuration. On the other hand, the use of the reactor with the old configuration resulted in the substantial loss of cobalt (27%) during the reaction. FT-IR spectra of the recovered catalysts are consistent with the metal analysis results. 2 tables.

19618 (EPRI-AP—2844-Vol.2) Evaluation of US coal performance in the Shell Coal Gasification Process (SCGP). Volume 2. Illinois No. 5 seam coal. Final report. Heitz, W.L.; McCullough, G.R.; Seth, M.; van Kessel, M.M. (Shell Oil Co., Houston, TX (USA)). Feb 1984. 102p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Shell Coal Gasification Process (SCGP) was included in the EPRI evaluation of the more promising gasification technologies. To date, performance data for SCGP have been available mostly for European coals. This report evaluates the performance of an Illinois No. 5 coal in the SCGP. Tests were conducted in the process development unit (6 metric ton per day nominal throughput) at the Shell Internationale Research Maatschappij B.V. Amsterdam laboratory. Shell also has a 150 metric ton per day gasification process development unit at Deutsche Shell's Harburg Refinery, Federal Republic of Germany. A total of 90 metric tons of Illinois No. 5 seam coal was gasified during approximately 390 hours of tests in the SCGP process development unit. Apart from feeding difficulties associated with the first batch of coal, caused by the variability in vendor grinding, the plant operation was normal. Illinois No. 5 seam coal has a gasification and slagging behavior similar to other bituminous coals. Normal carbon conversions of 85 to 99% were obtained for oxygen/MAF coal ratios of 0.90 to 1.04, even with a coal of relatively high moisture content (7 to 12% w). Carbon conversions above 90% were achieved at oxygen/MAF coal ratios of 0.9 and a feed moisture content below 4.8%w. An extensive evaluation of potential environmental problems was conducted. No priority pollutant organics could be detected above 1 ppbw in the aqueous effluent during steady state operation. Electric power generation is a major potential use of medium Btu gas from coal gasification. In order to eliminate the need for gas storage, it is desirable that the gasifier be able to respond rapidly to load changes. To test the transient response, coal throughput was varied by 50% with virtually no effect observed on reactor pressure. Illinois No. 5 seam coal is a good feedstock for the Shell Coal Gasification Process. 35 figures, 24 tables.

19619 (EUR—8508-DE) Round table meeting on chemical and physical valorization of coal. (Commission of the European Communities, Luxembourg). 1983. 155p. (CONF-8211149—). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

The solvent extraction/hydrogenation route for the production of liquid fuels and chemical raw materials from coal is discussed from the point of view of process development, raw material characteristics and the products obtained. The manufacture of high-temperature plastics from coal derived raw materials is also examined. Coal conversion by pyrolysis in the presence of hydrogen is reviewed and the processing of precarbonized coal is considered in detail. All papers have been abstracted individually.

19620 (EUR—8508-DE, pp 1-14) Pilot plant for the continuous hydroliquefaction of coal. Schiber, J. 1983. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8211149—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

The pilot plant (capacity 5 to 10 kg/h) for coal hydroliquefaction which has been constructed and operated at Cerchar as part of the research programme of the GECH (Groupe d'Etude de la Conversion du Charbon par Hydrogenation) is described. The background to the project and current operating results are discussed.

19621 (EUR—8508-DE, pp 15-38) **Continuous fluidized-bed extraction and catalytic hydrogenation of the extract.** Meier zu Koecker, H.; Glaeser, B.; Hellwig, U.; Noack, R.; Saygili, M.; Taetz, F. 1983. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8211149—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

Coal is extracted using tetralin under fluidized-bed conditions, and the resulting extract is catalytically hydrogenated under high pressure. A continuous process installation has been set up with an hourly coal throughput of 1-2 kg. (2 refs.)

19622 (EUR—8508-DE, pp 39-54) **Comparative hydrogenation tests with coal from the Ruhr and from the USA.** Hodek, W. 1983. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8211149—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

When assessing the suitability of coal for hydrogenation it is necessary to carry out autoclave tests for each particular coal sample. These test results cannot, however, be transferred directly to industrial installations. Real information on the suitability of coal for hydrogenation can only be obtained by comparing the hydrogenation results with those of approved hydrogenation coals. The usefulness of such comparative tests can be demonstrated by taking as an example the investigation of Kentucky coals. Compared with Ruhr coal, these Kentucky coals are highly reactive and can be hydrogenated at relatively low hydrogen pressures, the hydrogenation process being assisted, if required, by means of active catalysts. Coals from the Ruhr require higher pressures at which the application of active catalysts brings no significant process benefits. The hydrogenation of the US coal is also favoured because of its content of catalytically active minerals. These facts alone mean that US hydrogenation processes can be implemented at lower pressures than is the case with West German processes. (In German)

19623 (EUR—8508-DE, pp 55-81) **Hydrogenolysis of coal-derived liquids.** Bernhardt, R.S.; Fynes, G.; Ladner, W.R.; Newman, J.O.H. 1983. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8211149—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

The hydrogenolysis of partially hydrogenated anthracene oil and partially hydrogenated coal extract (middle oil) at >1000 K for 0.2-2 s in <44 bar hydrogen is shown to yield mainly benzene, ethane, methane and naphthalenes. The proportions depended on the severity of the reaction conditions. The yields of C_2-C_4 unsaturates were insignificant. Hydrogenolysis of partially hydrogenated coal extract for 0.2 s at the highest temperature of 1270 K yielded benzene and 0.6% ethane. Moderate conditions (1150 K for 0.6 s) gave 20% benzene, 12% ethane and 15% naphthalene. Hydropyrolysis of partially hydrogenated coal extract at higher pressures (150 and 300 bar) and less intensive heat-treatment conditions (1023 K for 5 s) gave up to 33% benzene, 32% ethane and 24% methane. Thus, hydrogenolysis and hydropyrolysis of partially hydrogenated coal-derived liquids are possible routes from coal to chemical feedstocks. (11 refs.)

19624 (EUR—8508-DE, pp 83-114) **Hydrogen-pyrolysis - a third option for coal conversion.** Cypres, R.; Furfari, S.; Tilte-Neumann, C.; Ghodsi, M. 1983. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8211149—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

This paper describes recent Belgian work on coal hydrogenpyrolysis (pyrolysis in an hydrogen environment). It discusses the advantages of this technique, which requires little financial investment. Laboratory tests on the effect of different parameters on the quantity and quality of the yield products (gas, tar, semi-coke) are described. Details of hydrogen comsumption are presented. Desulphurization of the semi-coke and the energy efficiency of the process are discussed. (21 refs.) (In French)

19625 (EUR—8508-DE, pp 115-125) **Hydrogen-pyrolysis of pre-carbonised coal.** Cypres, R.; Ghodsi, M.; Lempereur, J.P.; Tilte, C.; Braekman, C. 1983. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8211149—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

An investigation was carried out into the capacity of coke and char, which had been pre-formed in an inert atmosphere, to undergo a second devolatilization stage under hydrogen pressure. Coals of different rank were either directly hydrogenated or carbonized in helium at different temperatures and pressures, after which they underwent gasification in hydrogen. It can be seen that rapid devolatilization once again takes place in the initial phase and one can expect gasification rates similar to those obtained from direct hydrogen treatment. (5 refs.)

19626 **(ORNL—5782) Liquefaction technology assessment - Phase II: indirect liquefaction of coal to gasoline using Texaco and Koppers-Totzek gasifiers.** Irvine, A.R.; Wham, R.M.; Fisher, J.F.; Salmon, R.; Ulrich, W.C. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 506p. NTIS, PC A22/MF A01; 1; GPO Dep. Order Number DE84009359.

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This report provides a comparison of two entrained-flow gasifiers - the Koppers-Totzek and the Texaco - for use in a plant to convert coal to gasoline by an indirect method. The results of the current study are also compared with those from a previous study that employed a Lurgi gasifier for the same purpose. Koppers-Totzek- and Texaco gasifiers-equipped plants were estimated to be economically competitive for the operational parameters used in this study when a high-water-content western coal was used as feed, but the Texaco gasifier-based plant was indicated to be more economical than the Koppers-Totzek-based plant when eastern bituminous coal was used as feed. A Lurgi gasifier- and methane reformer-equipped plant was calculated to be significantly more economical than either of the plants equipped with entrained-flow gasifiers when processing western coal; however, the combination of uncertainties and potential for process improvement associated with these gasifiers makes this conclusion tenuous. To date, the Texaco gasifier has only been used to gasify coal at the demonstration plant scale, whereas the Koppers-Totzek gasifier is in commercial use.

19627 **The catalysis of coal gasification.** McKee, D.W.; Kosky, P.G.; Lauby, E.J.; Spiro, C.L. (General Electric Corp. Research and Development Center, Box 8, Schenectady, NY 12301). *CHEMTECH;* **13**: No. 10, 624-629(Oct 1983). Contract AC21-80MC14591.

This article investigates possible catalysis mechanisms and the effects of mineral impurities using a typical char and a pure graphite powder. Chemical reactions in the presence and absence of added alkali catalysts are compared. Catalytic effects of alkali carbonates and other salts in the gasification of coal char and graphite in steam and CO_2 were studied. Patterns of catalytic activity for the various additives are similar for both char and graphite. Mechanisms for the alkali carbonate catalysis that rely on metal atom formation are thermodynamically feasible. The reactivity of char is influenced by such factors as charring temperature, porosity, and the presence of mineral impurities.

0105 By-products

REFER ALSO TO CITATION(S) 19619

19628 (EUR—8508-DE, pp 127-139) **Preparation of thermally stable resins from phenanthrene.** Price, D.W.; Robinson, J.G. 1983. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8211149—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

Polyamic acids) were prepared by first converting phenanthrene to 9,10-dihydroxyphenanthryl methane (and higher oli-

gomers) and thence by oxidation and dehydration reactions to a product constituted of diphenic anhydride units joined by carbonyl bridges. This product was then treated with 1,4-diaminobenzene to give a poly(amic acid). This product on heating at 300°C gave a polymer whose thermal stability increased with decreasing the proportion of diamine to anhydride used in the preparation of the parent poly(amic acid) from 1:1 to 0.25:1. (9 refs.)

19629 **Hydroprocessing of organo-oxygen compounds in coal liquids catalyzed by sulfided Ni-Mo/γ-Al_2O_3.** Li, C.L. (Univ. of Delaware, Newark); Katti, S.S.; Gates, B.C.; Petrakis, L. *Journal of Catalysis;* **85**: No. 1, 256-259(Jan 1984).

Coal liquids and shale oil contain high concentrations of organo-oxygen compounds. The reactivities of the organo-oxygen compounds on these coal-liquid fractions are summarized. The results were obtained with a high-pressure flow microreactor; some were determined with a batch reactor. The catalyst was presulfided Ni-Mo/γ-Al_2O_3. 3 figures, 1 table.

0106 Properties

REFER ALSO TO CITATION(S) 19618, 19629, 19662, 19663, 19664, 19690

19630 **(DOE/BC/10188—33) Syncrude stability study. Final report, June 9, 1980-March 31, 1983.** Bowden, J.N.; Lee, G.H. II. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). 1983. Contract AC19-80BC10188. 78p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84009788.

This program was initiated to investigate the storage stability of syncrudes derived from coal and oil shale, and upgraded syncrudes, by procedures utilized for petroleum-derived fuels. Initially, the syncrudes were placed in storage at 43°C. After 4, 8, 16 and 24 weeks, aliquots were removed from storage for analysis of filterable precipitates, adherent gum, and soluble gum. Due to the high viscosity and boiling range of many of the syncrudes, special techniques were utilized to filter some of these samples for their measurements, which included heat and pressure. Investigation of other techniques for development of a test protocol that would successfully differentiate between various degrees of storage stability of syncrudes became a second objective of this program. To this end, solvent separations, accelerated stability tests at 80°C, differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA) were investigated. Results of this work indicate that for the particular samples studied, the shale syncrudes are more stable than coal-derived syncrudes, and hydrotreatment of the shale syncrudes for upgrading tends to improve their stability. Thermal analysis by SC and/or TGA appears to show promise in evaluating syncrude stability, although finalized standard procedures still need to be developed. 10 references, 18 figures, 29 tables.

19631 **(DOE/FE/60181—52) Inorganic constituents in low-rank coal: direct coal analysis or ash analysis.** Benson, S.A.; Hurley, J.P.; Falcone, S.K.; Schobert, H.H. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 13p. (CONF-841048—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009232.

From Rocky Mountain coal symposium; Bismarck, ND, USA (2 Oct 1984).

The inorganic constituents in low-rank coals are distributed among ion-exchange sites of organic acid groups and clay minerals, coordination sites, oxides, and discrete mineral phases such as calcite, quartz, pyrite, and clay minerals. The unique ways in which these inorganics are bound within the coal can affect their behavior during ashing. The standard ASTM ashing procedure provides a means of concentrating inorganic constituents of the coals at 750°C. The ash cannot represent the inorganics present in the coal because partial volatilization of some species may occur and others combine to form secondary phases. Determination of inorganics directly in coals and selective extraction of the inorganics based on their bonding within the coal matrix together provide a much more accurate assessment of coal composition. The inorganics can be reported in three major categories: organically-bound cations; carbonate/coordinated/oxide; and insoluble mineral phases. A predicted ash content is calculated by summing (on an oxide basis) the inorganics determined in dry coal. Comparison of ash contents obtained by direct coal analysis and by ashing analysis for a Beulah, ND lignite indicates that the total ash-forming constituents determined from the direct coal analysis is 10.39%, whereas the ASTM ash content is 9.5%. The differences between these determinations are explained by 43% volatilization of sodium and a 25% loss of sulfur upon ashing. Further examination reveals that 90 to 95% of the total sodium in this coal is bound as cations to organic acid groups within the coal, and is thus more prone to volatilize than if it were associated with a mineral phase. The volatility of sodium in 30 low-rank coals shows a linear relationship between the amount of sodium volatilized and the total sodium in the coal with a correlation coefficient of 0.97. In these coals tested up to 67% of the total sodium was volatilized. 11 references, 2 figures, 2 tables.

19632 **(DOE/PC/60785—T1) Organic oxygen characterization of coal and coal liquids. Quarterly progress report, November-January, 1983.** Ehmann, W.D.; Hamrin, C.E. Jr.; Koppenaal, D.W. (Kentucky Univ., Lexington (USA)). Feb 1984. Contract FG22-83PC60785. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008274.

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Organically bound oxygen is one of the most abundant elements in coal, yet the amount and quality of data concerning its abundance, mode of occurrence, and processing behavior is relatively lean. The rectification of this problem will require the development of appropriate methods of oxygen determination, which have been lacking in the past. The stature of coal science today demands a technique for organic oxygen determination other than the outdated and error-prone oxygen-by-difference calculation. This investigation addresses this need and intends to develop methods suitable not only for total organic oxygen determination but also for determination of oxygen functionality. The methods and techniques developed will then be applied to practical needs in characterizing the oxygen geochemistry of coal and the evaluation of coal drying on liquefaction behavior. 16 references, 3 tables.

19633 **(DOE/PC/60803—T1) Thermodynamic behavior of coal liquids in the presence of coal solids characterization on ion and ash. Second quarterly progress report, November 1, 1983-February 1, 1984.** Holder, G.D.; Klara, S.M. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Feb 1984. Contract FG22-83PC60803. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007678.

The major goal of this project is to determine the effect of coal solids on the thermodynamic properties (i.e. vapor pressure) of coal liquids. Presently, the reliability of the apparatus is being tested using pure and binary component systems. The data obtained from the analysis is being compared to literature data in order to obtain an accurate estimate as to any error involved in the apparatus. Secondly, pure and multicomponent systems will be studied both with and in the absence of coal solids. This will enable a detailed examination of the effects of coal solids on coal liquid mixtures. Finally, an attempt will be made to derive correlations to model coal liquid systems in the presence of coal solids. During this past quarter, experiments have been conducted with the pure component systems of tetralin and toluene. Initially, the vapor pressure of tetralin and toluene was measured over a temperature interval of 80°C. The pressure was measured using a 0 to 50 psig transducer. All data were taken above the boiling point temperature of the compounds since below their boiling point, these compounds exert a vapor pressure of less than 0 psig (1 atm). Because the gauge transducer has a lower limit of 0 psig, it was necessary to insure that the compounds were at a high enough temperature to exhibit a pressure greater than this limit. The vapor pressures obtained experimentally were compared with those obtained from literature using Antoine's Equation. As can be seen in Tables I and II, the experimental and literature values of vapor pressure compared well with a maximum error of 4.6% for tetralin and 9.1% for toluene. 1 figure, 3 tables.

0108 Waste Management

REFER ALSO TO CITATION(S) 19613, 19982, 19983

19634 **(AD-P—002034/7) Automatic interpretation of mss (multispectral scanner)-landsat data applied to coal refuse site studies in southern Santa Catarina State, Brazil.** Kux, H.J.H.; Valeriano, D.D.M. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jun 1982. 10p. NTIS, PC A02/MF A01.

The coal mining district from southeastern Santa Catarina State is considered one of the most polluted areas of Brazil. This study presents the preliminary results on the application of MSS-LANDSAT digital data to monitor the coal refuse areas and its environmental consequences in this region.

19635 **(DOE/FE/60181—82) Use of rotating biological contactors for treating coal gasification wastewater.** Strain, J.; Turner, C. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 2p. (CONF-8404105—7). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009350.

From North Dakota Academy of Science conference; Fargo, ND, USA (26 Apr 1984).

The two objectives of this study were to determine the feasibility of using Rotating Biological Contractors (RBC) for the treatment of coal gasification wastewater and to define a range of hydraulic and organic loadings for the reactors, within which process stability can be maintained. Despite a 50% increase in the hydraulic loading to the RBC the unit remained stable with only a 20% reduction in BOD_5 removal. The study showed that a RBC can achieve high biodegradable organic removal under the range of hydraulic and organic loadings tested. The RBC also proved to be stable during rapid fluctuations in thiocynate and cyanide loadings that upset activated sludge reactors being operated simultaneously with the same SGL.

19636 **(DOE/FE/60181—83) Effect of phosphorous addition to model cooling towers using coal gasification wastewater as makeup.** Priebe, B.D.; Turner, C.D. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 3p. (CONF-8404105—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009349.

From North Dakota Academy of Science conference; Fargo, ND, USA (26 Apr 1984).

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Cooling towers are an integral part of in-plant water reuse systems in industries such as the Great Plains Gasification Plant being constructed at Beulah, North Dakota. Cooling towers can be used to reduce water requirements, remove biodegradable organics, and concentrate non-biodegradable compounds for ultimate disposal while accomplishing the basic water cooling function. The gasification wastewater used in cooling towers at coal gasification plants must be pretreated using solvent extraction and ammonia stripping to produce stripped gas liquor (SGL). The SGL remains contaminated with organics, ammonia (NH_3), cyanides (CN), and thiocyanates (SCN) but at levels that microorganisms can acclimate to in cooling towers. The objective of this investigation was to examine the effects of adding phosphorous to the nutrient deficient SGL in order to improve organics removal and to evaluate changes in biofouling and corrosion in the model cooling towers. The removal of contaminants from SGL was shown to be enhanced by the addition of phosphorous to makeup water for use in cooling towers. Unfortunately, the attached and suspended deposits became an increasing problem in terms of clogging the tower packing and tubing.

19637 **(DOE/MC/16359—1521) Acoustic agglomeration of power plant fly ash. Final report.** Reethof, G.; McDaniel, O.H. (Pennsylvania State Univ., University Park (USA)). 1982. Contract AC21-81MC16359. 159p. (CAES—692-83). NTIS, PC A08/MF A01. Order Number DE84004863.

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The work has shown that acoustic agglomeration at practical acoustic intensities and frequencies is technically and most likely economically viable. The following studies were performed with the listed results: The physics of acoustic agglomeration is complex particularly at the needed high acoustic intensities in the range of 150 to 160 dB and frequencies in the 2500 Hz range. The analytical model which we developed, although not including nonlinear acoustic efforts, agreed with the trends observed. We concentrated our efforts on clarifying the impact of high acoustic intensities on the generation of turbulence. Results from a special set of tests show that although some acoustically generated turbulence of sorts exists in the 150 to 170 dB range with acoustic streaming present, such turbulence will not be a significant factor in acoustic agglomeration compared to the dominant effect of the acoustic velocities at the fundamental frequency and its harmonics. Studies of the robustness of the agglomerated particles using the Anderson Mark III impactor as the source of the shear stresses on the particles show that the agglomerates should be able to withstand the rigors of flow through commercial cyclones without significant break-up. We designed and developed a 700°F tubular agglomerator of 8″ internal diameter. The electrically heated system functioned well and provided very encouraging agglomeration results at acoustic levels in the 150 to 160 dB and 2000 to 3000 Hz ranges. We confirmed earlier results that an optimum frequency exists at about 2500 Hz and that larger dust loadings will give better results. Studies of the absorption of acoustic energy by various common gases as a function of temperature and humidity showed the need to pursue such an investigation for flue gas constituents in order to provide necessary data for the design of agglomerators. 65 references, 56 figures, 4 tables.

19638 **(DOE/PC/30231—T5-Vol.1) Sorbate characteristics of fly ash. Volume I. Final report.** Liskowitz, J.W.; Grow, J.; Sheih, M.; Trattner, R.; Kohut, J.; Zwillenberg, M. (New Jersey Inst. of Tech., Newark (USA); Public Service Electric and Gas Co., Newark, NJ (USA)). Aug 1983. Contract FG22-80PC30231. 228p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84007948.

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The objective of this investigation is to correlate the sorbate and leaching characteristics of fly ash with coal properties and monitored combustion conditions in order to design a system for the inexpensive treatment of industrial wastes and leachate from industrial landfills using mixtures of fly ash as inexpensive sorbents. Such a low-cost treatment system could also treat ash pond effluent for water reuse by powerplants as cooling tower makeup. Twelve unblended coals from 10 different mines were burned under monitored conditions in three different types of coal fired boilers in order to determine the influence of coal composition, ash fusion temperatures, boiler additives, combustion conditions and co-firing of natural gas or oil with the coal, on the leaching and sorbate characteristics of the fly ash produced. This included the determination of: (1) SiO_2, Al^3O_3, Fe_2O_3, CaO, K_2O, Na_2O, MgO, sulfur, ash fusion temperatures Ti, Cd, Sn, Ni, Pb, Mo, Cu, Cr, n, Mn, Ba and V in the coals and their respective fly ashes and bottom ashes; (2) Moessbauer spectra of a number of coals and their fly ashes; and (3) surface analysis of the fly ashes using ESCA. The leaching exhibited by the fly ashes with regard to pH, Cd, B, Sn, Ni, Pb, Mo, Cu, Cr, Mn and Fe was examined. In addition, the removal of Cd, B, Sn, Ni, Pb, Mo, Cu, Cr, Fe, As and organics by fly ash was evaluated, using from actual ash pond samples to model realistic inlet concentrations. The results show that fly ash can be used for the treatment of Cadmium, Boron, Tin, Molybdenum, Nickel, Lead, Copper, Chromium, Zinc, Manganese, Iron, Arsenic and organics in actual ash pond effluents. 18 references, 64 figures, 60 tables.

19639 **(DOE/PC/30231—T5-Vol.2) Sorbate characteristics of fly ash. Volume II, appendix. Final report.** Liskowitz, J.W.; Grow, J.; Sheih, M.; Trattner, R.; Kohut, J.; Zwillenberg, M. (New Jersey Inst. of Tech., Newark (USA); Public Service Electric and Gas Co., Newark, NJ (USA)). Aug 1983. Contract FG22-80PC30231. 255p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84007949.

The objective of this investigation is to correlate the sorbate and leaching characteristics of fly ash with coal properties and monitored combustion conditions in order to design a system for the inexpensive treatment of industrial wastes and leachate from in-

dustrial landfills using mixtures of fly ash as inexpensive sorbents. Such a low-cost treatment system could also treat ash pond effluent for water reuse by powerplants as cooling tower makeup. Twelve unblended coals from 10 different mines were burned under monitored conditions in three different types of coal fired boilers in order to determine the influence of coal composition, ash fusion temperatures, boiler additives, combustion conditions and co-firing of natural gas or oil with the coal, on the leaching and sorbate characteristics of the fly ash produced. This included the determination of: (1) SiO_2, Al_2O_3, Fe_2O_3, CaO, K_2O, Na_2O, MgO, sulfur, ash fusion temperatures Ti, Cd, Sn, Ni, Pb, Mo, Cu, Cr, n, Mn, Ba and V in the coals and their respective fly ashes and bottom ashes; (2) Moessbauer spectra of a number of coals and their fly ashes, and (3) surface analysis of the fly ashes using ESCA. The leaching exhibited by the fly ashes with regard to pH, Cd, B, Sn, Ni, Pb, Mo, Cu, Cr, Mn and Fe was examined. In addition, the removal of Cd, B, Sn, Ni, Pb, Mo, Cu, Cr, Fe, As and organics by fly ash was evaluated, using from actual ash pond samples to model realistic inlet concentrations. The results show that fly ash can be used for the treatment of Cadmium, Boron, Tin, Molybdenum, Nickel, Lead, Copper, Chromium, Zinc, Manganese, Iron, Arsenic and organics in actual ash pond effluents. This volume contains data on leaching and treatment of Cd, B, Sn, Mb, Ni, Pb, Cu, Cr, Zn, Mn, Fe and As from coal fly ash. 349 figures.

19640 **(DOE/PC/30233—T4) Treatment of coke-oven wastewater with the powdered activated carbon-contact stabilization activated sludge process. Final report.** Suidan, M.T.; Deady, M.A.; Gee, C.S. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). Nov 1983. Contract FG22-80PC30233. 149p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84008300.

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The objective of the study was to determine optimum parameters for the operation of an innovative process train used in the treatment of coke-over wastewater. The treatment process train consisted of a contact-stabilization activated sludge system with powdered activated carbon (PAC) addition, followed by activated sludge nitrification, followed by denitrification in an anoxic filter. The control and operating parameters evaluated during the study were: (a) the average mixed-liquor PAC concentration maintained in the contact-stabilization system, (b) the solids retention time practiced in the contact-stabilization system, and (c) the hydraulic detention time maintained in the contact aeration tank. Three identical treatement process trains were constructed and employed in this study. The coke-oven wastewater used for this investigation was fed to the treatment units at 30% strength. The first part of the study was devoted to determining the interactions between the mixed liquor PAC concentration and the solids retention time in the contact-stabilization tanks. Results showed that optimum overall system performance is attainable when the highest sludge age (30 day) and highest mixed liquor PAC concentration were practiced. During the second phase of the study, all three systems were operated at a 30 day solids retention time while different detention times of 1, 2/3 and 1/3 day were evaluated in the contact tank. PAC addition rates were maintained at the former levels and, consequently, reduced contact times entailed higher mixed liquor carbon concentrations. Once again, the system receiving the highest PAC addition rate of PAC exhibited the best overall performance. This system exhibited no deterioration in process performance as a result of decreased contact detention time. 72 references, 41 figures, 24 tables.

19641 **(DOE/PC/60266—T2) Configurational testing of electron beam ionization for coal fly ash precipitators. Quarterly report No. 2, November 5, 1983-February 4, 1984.** Davis, R.H. (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1984. Contract AC22-83PC60266. 39p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009312.

The energy-geometry matching condition reported in Quarterly Report No. 1 has been incorporated in the design of a Mark II precharger and construction is underway. By matching the energy and geometry, monopolar charging is assured by providing a charging zone outside the ionization zone. Particle charges greater than the Pauthenier limit were observed using a bi-electrode geometry. Either or both free electron charging or space-charge enhancement of the electric field may be responsible for the increase in charge above the theoretical limit for the average electric field. A separate experiment on free electron charging proceeded during this quarter and the progress is reported. To date the exhaustive experiments on resistance modification by simple electron beam irradiation have not provided evidence to support practical utilization. However, preliminary experiments do suggest that the presence of small amounts of SO_3 and the subsequent conversion of SO_2 by electron beam treatment may conductively coat high resistivity fly ash particles with a resultant reduction in resistivity. The status of the laboratory precipitator test system is reported along with the preparations for tests of the new Mark II precharger module. During this quarter a patent disclosure on a device to enhance radiation dose was submitted to the US Department of Energy. 13 figures.

19642 **(EPRI-CS—3122-Vol.1) Coal combustion by-products utilization manual. Volume 1. Evaluating the utilization option. Final report.** Kurgan, G.J.; Balestrino, J.M.; Daley, J.R. (Baker (Michael), Jr., Inc., Beaver, PA (USA)). Feb 1984. 687p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Coal Combustion By-Products Utilization Manual presents a procedure for use by utility company personnel in assessing the feasibility of by-product utilization for individual utility circumstances. In achieving the objective of a manual, coal combustion by-product utilization is documented both regionally and nationally. A basic systems approach to developing a by-products utilization management plan is presented at the outset of the Manual, identifying the major decision making steps. Each subsequent Manual section highlights a particular step in the management plan, discussing in detail its principal components and state-of-the-art technological developments. Coal combustion by-product utilization practices can vary depending on the inherent by-product characteristics. For this reason, the Manual differentiates between Class F fly ash (normally produced from bituminous and anthracite coals) and Class C fly ash (normally produced from subbituminous and lignite coals), where applicable. The final two Manual sections refine the overall utilization management plan into a specific procedure to assess the feasibility of any given power station utilization program. After the procedure is theoretically presented and discussed, it is applied at an existing utility power station as a test case study analysis. Volume 2 presents an annotated bibliography of all references used in the development of this Manual. Also included are publications not referenced in Volume 1 which could be used for more detailed information. 46 figures, 109 tables.

19643 **(EPRI-CS—3354-Vol.1) Investigation of ammonium sulfate conditioning for cold-side electrostatic precipitators. Volume 1. Field and laboratory studies. Final report.** Gooch, J.P.; Bickelhaupt, R.E.; Dismukes, E.B. (Southern Research Inst., Birmingham, AL (USA)). Feb 1984. 68p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report is the first volume in a two-volume set dealing with ammonium sulfate conditioning for cold-side electrostatic precipitators. This volume (Volume 1) presents the results of field studies of ammonium sulfate conditioning performed by Southern Research Institute at two pulverized coal-fired power plants: the Corette Station of Montana Power Company and the Gannon Station of Tampa Electric Company. Volume 2 of this set, which was prepared by Stearns-Roger Engineering Corporation, presents an engineering and economic analysis of the gas conditioned precipitators at both plants. Ammonium sulfate is one of the chemical additives known as flue gas conditioning agents that are used to improve the performance of electrostatic precipitators in coal-burning electric power generating stations. This compound has the potential of increasing the efficiency of fly ash collection by (1) lowering the electrical resistivity of the fly ash and suppressing sparking or back corona, (2) increasing the cohesiveness of the ash and suppressing reentrainment, (3) producing a fume of fine particles and increasing the useful voltage in the precipitator, or (4) causing particle agglomeration and overcoming the relatively low collection efficiency for small particles. Conditioning with ammonium sulfate was investigated in two power plants burning low-sulfur coals and thus producing fly ashes of inherently high resistivities. In these plants, the beneficial effect of ammonium sulfate conditioning in cold-side precipitators was quantitated. In addition, the primary mechanism of

conditioning was identified. This mechanism was the lowering of resistivity through the influence of sulfur trioxide that is made available by thermal decomposition of the conditioning agent. 12 references, 15 figures, 15 tables.

19644 **(EPRI-CS—3354-Vol.2) Investigation of ammonium sulfate conditioning for cold-side electrostatic precipitators. Volume 2. Engineering and economic analysis.** Pearson, R.S. (Stearns-Roger Corp., Denver, CO (USA)). Feb 1984. 103p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report is the second volume in a two-volume set dealing with ammonium sulfate conditioning for cold-side electrostatic precipitators. Volume 1, which was prepared by Southern Research Institute, presents the results of field studies of ammonium sulfate conditioning at two pulverized coal-fired power plants: the Corette Station of Montana Power Company and the Gannon Station of Tampa Electric Company. This report (Volume 2) presents an engineering and economic analysis of the gas conditioned precipitators at each station. This analysis includes an examination of the capital and operating costs, operating and maintenance problems, and an assessment of the economic feasibility of the conditioning systems for enhancement of particulate removal. The economic analyses compare the use of flue gas conditioning with the installation of additional plate area to obtain the same collection efficiency. At both stations, the use of ammonium sulfate conditioning was economically favored over the addition of plate area. Operating and maintenance problems were found to be relatively minor at both stations. Maintenance problems analyzed at the Corette Station included electrode failures, purge system corrosion, fly ash removal system problems, freezing and plugging of the chemical injection system, and air preheater plugging. None of these maintenance problems were excessively expensive or cause prolonged system outages. At the Gannon 6 Station, analysis of electrode failures, interlock system contamination by solids, and fly ash hopper valve plugging also indicated that maintenance costs were not excessive. 16 figures, 35 tables.

19645 (EUR—8508-DE, pp 141-150) **Investigations to improve the performance of active carbon in the treatment of malodorous gaseous effluent.** Perret, R. 1983. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8211149—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (16 Nov 1982).

This paper reports on the research undertaken by Cerchar into improving deodorisation techniques by means of active carbon. The three areas of research were: increase in the retention capacity of active carbon with respect to malodorous substances; in-situ regeneration of saturated carbon; and use of low-cast carbon to eliminate the need for regeneration.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 19612, 19613, 19634, 19655, 20733

19646 **(FERC/EIS—0013) Cross steamplant at Santee-Cooper Project No. 199, South Carolina. Final environmental impact statement.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Jul 1980. 297p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84009440.

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South Carolina Public Service Authority (Applicant) is proposing to construct and operate a four-unit coal-fired steam electric generating plant (1800 MWe total) at a site located adjacent to the Diversion Canal connecting Lakes Marion and Moultrie, of the licensed Santee-Cooper Hydroelectric Project, FERC No. 199, in Berkeley County, South Carolina. This action would require the construction of intake and discharge structures across Project No. 199 land and into the canal and the withdrawal of up to 37.5 mgd from the canal, the construction of a 10.5-mile rail spur, and approximately 180 miles of new and widened transmission corridors. Construction would commence in 1980, and be completed in 1988. 113 references, 41 figures, 51 tables.

19647 **Evaluation of hydrotreatment as a means of reducing biological activity of synfuel related materials.** Schultz, T.W.; Dumont, J.N.; Rao, T.K.; Guerin, M.R.; Ma, C.Y.; Epler, J.L. *Environmental Research;* **29**: No. 2, 389-398(Dec 1982). Contract W-7405-ENG-26.

Raw and hydrotreated product liquids from process demonstration units of experimental "H-coal" and "solvent-refined coal" processes were examined for acute toxicity monitored as population growth impairment of Tetrahymena exposed to aqueous extracts and for mutagenic activity monitored as revertants of Salmonella exposed to metabolically activated chemical class fractions. With both systems, deleterious effects are generally reduced as the severity of hydrotreatment is increased. The major exception appears to be with the low severity hydrotreated H-coal distillate where mutagenicity in the polyaromatic fraction is slightly enhanced over that of the raw distillate. However, medium to high severity hydrotreatment appears to be an effective means of reducing biological activity monitored presumably by reducing aromaticity and heteroatom content.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 21154

19648 **(DOE/ET/10723—1545) Geology of the Hanna Formation, Hanna Underground Coal Gasification Site, Hanna, Wyoming.** Oliver, R.L.; Youngberg, A.D. (Associated Western Universities, Inc., Salt Lake City, UT (USA)). Jan 1984. Contract AC07-76ET10723. 155p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84003077.

The Hanna Underground Coal Gasification (UCG) study area consists of the SW1/4 of Section 29 and the E1/2SE1/4 of Section 30 in Township 22 North, Range 81 West, Wyoming. Regionally, this is located in the coal-bearing Hanna Syncline of the Hanna Basin in southeast Wyoming. The structure of the site is characterized by beds dipping gently to the northeast. An east-west fault graben complex interrupts this basic trend in the center of the area. The target coal bed of the UCG experiments was the Hanna No. 1 coal in the Hanna Formation. Sedimentary rocks comprising the Hanna Formation consist of a sequence of nonmarine shales, sandstones, coals and conglomerates. The overburden of the Hanna No. 1 coal bed at the Hanna UCG site was divided into four broad local stratigraphic units. Analytical studies were made on overburden and coal samples taken from cores to determine their mineralogical composition. Textural and mineralogical characteristics of sandstones from local stratigraphic units A, B, and C were analyzed and compared. Petrographic analyses were done on the coal including oxides, forms of sulfur, pyrite types, maceral composition, and coal rank. Semi-quantitative spectrographic and analytic geochemical analyses were done on the overburden and coal and relative element concentrations were compared. Trends within each stratigraphic unit were also presented and related to depositional environments. The spectrographic analysis was also done by lithotype. 34 references, 60 figures, 18 tables.

19649 **(USGS-OFR—79-1140) Coal resources of southeastern Massachusetts assessed in 1942.** Chute, N.E. (Geological Survey, Reston, VA (USA)). 1979. 39p. Geological Survey, Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

The data available concerning the coal-bearing Rhode Island formation is so meager that it is impossible, except in a very general way, to outline its coal producing potentialities. A prospecting program undertaken in this region would be essentially a wildcat enterprise based largely on chance. Thin non-commercial coal beds may be numerous and widespread but there is no assurance that thick extensive coal beds capable of producing large quantities of coal could be found. So far all of the coal mining efforts in Massachusetts have ended in failure. The writer has no exact figures but the records suggest that nearly half a million dollars were spent in prospecting and development work on coal in Mansfield. In all as much as 5000 to 7000 tons of coal may have been mined, but the mines never got much beyond the development stage and brought very little in returns to their owners. The failure of the mines cannot be blamed entirely on mismanagement or on lack of funds.

The history of the mines shows clearly that insufficient coal was found to make them profitable. Should determination of the coal resources of the Narragansett Basin be considered important enough to justify a prospecting program, even though the results may be negative, suggestions concerning procedure are offered. 69 references, 4 figures.

19650 **(USGS-OFR—79-1173) Lithologic and geophysical logs and coal analyses from test holes drilled during 1977 in Converse and Campbell Counties, Wyoming.** Kistner, F.B.; Hollomon, G.A.; Coppock, D.G. (Geological Survey, Reston, VA (USA)). 1979. 91p. Geological Survey, Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

Between August 11 and November 16, 1977, 28 coal test holes were drilled in Converse and Campbell Counties, Wyoming (figure 1). This drilling was done as part of an ongoing US Geological Survey program to evaluate and classify mineral lands in the public domain. The overall purpose of the program is to gather data on the thickness, quality, extent, correlation, and recoverability of coal beds, and the thickness and lithologic characteristics of the associated rocks in the Tertiary Fort Union and Wasatch Formations of the Powder River Basin. This report presents geophysical logs and lithologic descriptions, lagged or corrected in depth intervals to match the geophysical logs of each test hole, and analyses of coal samples obtained from three offset core holes. Similar information from 343 test holes and approximately 149 coal samples from 53 core tests in Campbell and Converse Counties, Wyoming, was presented in earlier reports (US Geological Survey and Montana Bureau of Mines and Geology, 1973, 1974, 1976a, 1976b, 1977, 1978; Kistner, 1977). Figure 1 shows the locations and test-hole numbers of all holes drilled during the 1977 field season. 8 references, 1 figure, 5 tables.

19651 **(USGS-OFR—82-281) Coal references index for the Navajo Indian Reservation, Arizona, New Mexico, and Utah.** Bliss, J.D. (Geological Survey, Menlo Park, CA (USA)). Jan 1982. 16p. Geological Survey, Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

The references listed in this document represent the readily available literature about coal resources on or adjacent to the Navajo Indian Reservation. They were selected during the developmental phase of the Navajo Resource Information System (NRIS). The system contains a set of computerized data bases addressing various resource categories. The system was developed by the US Geological Survey in coordination with the Minerals Department, Navajo Nation. Funding support was provided by the Bureau of Indian Affairs. The list of approximately 70 references was selected from a reference data base entitled nref using those citations which contain coal in a keyword list attached to each citation. The main attempt was to list most of the literature published in the 1960's and 1970's for areas in, or adjacent to, the Navajo reservation.

0120 Mining

REFER ALSO TO CITATION(S) 19690

19652 **(CONF-831112—5) Significance of hydrologic considerations in planning Gulf Coast surface lignite mines.** Gaddis, B.L. (Phillips Coal Co., Richardson, TX (USA)). 16 Nov 1983. 18p. Phillips Coal Co., 2929 N. Central Expressway, Richardson, TX 75080.

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

Surface and ground water resources are either effected by or influence planning and operational considerations for mining lignite in the Gulf Coast. Hydrologic studies to characterize, explain, and predict spacial-temporal effects on or by the water resource as part of the mine planning process are mandatory. Techniques and methods available to characterize, accommodate, monitor, and manage this resource prior to, during, and after mining operations continues to be an active and progressive area due to the wide variety of acceptable and prudent means to acquire a site-specific hydrologic understanding and the need to engineer control measures that satisfy regulatory requirements. Economical mining plans which are responsive to conscientious environmental practices as well as accommodate lignite supply needs require adequate water control engineering based on a suitable understanding of the hydrologic regime. This understanding is best accomplished by a systems approach to hydrologic characterization and awareness of the non-hydrologic factors affecting water resource system response, control and management. 21 references, 4 figures, 2 tables.

19653 **(DOE/FE/00016—T24) Technical progress report No. thirty-one, 1 February-29 February 1984.** (Foster-Miller Associates, Inc., Waltham, MA (USA)). 19 Mar 1984. Contract AI01-81FE00016. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009196.

The objective of this program is to evaluate the effectiveness of available dust control technology for double-drum shearer longwall sections in a coordinated, systematic program at a few longwall test sections, and to make the results available to the entire coal mining industry. Methods of controlling dusts at several longwall mines were examined and measurements made of dust concentrations at various positions at and near the face are reported. 4 figures, 1 table.

19654 **(DOE/MC/19404—T14) Measurement of dynamic reservoir conditions. Technical progress report.** Boyer, C.M. II. (United States Steel Corp., Monroeville, PA). Jan 1984. Contract AC21-82MC19404. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009302.

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Technical progress report on the drainage borehole DHM-7 at the Oak Grove Test Site for January 1984 is presented. In addition, daily production data for January from drainage borehole DHM-4 are included in Appendix Table I. During January 1984, the water level in borehole DHM-7 continued to drop. On January 10, 1984, the water level was 829.77 feet above the Mary Lee seam and was declining at a rate of 1.2 foot per day, Table I. By January 25, 1984, the water level had dropped to 814.87 feet and was continuing to decline at a rate of 1.0 foot per day. It is now estimated that the water column should reach equilibrium in late March 1984. 1 table.

19655 **(FWS/OBS—81/09) Surface mine reclamation for wildlife.** (Tennessee Valley Authority, Norris (USA). Div. of Land and Forest Resources). Jun 1981. 39p. NTIS, PC A03/MF A01. Order Number DE84900909.

This document presents a reclamation plan for use on surface coal mines in southern Appalachia. The plan has been implemented cooperatively by TVA and the FWS on a mine site in Campbell County, Tennessee. Included are suggestions for establishing groundcover and trees on the mine site, and for retaining surface water on mine sites. All techniques discussed are to benefit wildlife and to assist the operator in achieving bond release. Also included is a section on the costs of reclaiming the Campbell County study site to benefit forestry and wildlife. The costs of this project are compared to the costs of reclaiming a more traditional forestry (monoculture) option. The comparison showed the techniques at the study site to be less costly than those that would be associated with a forestry option. 11 references, 14 figures, 2 tables.

19656 **(NP—4770194) Principles of business management as exemplified by the Salzach Coal Mining Society.** Pirklbauer, S.M. (Salzach-Kohlenbergbau G.m.b.H., Trimmelkam (Austria)). 1983. 11p. (In German). NTIS (US Sales Only), PC A02. Order Number DE84770194.

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The special activities of the SAKOG management are outlined. While the daily struggle with difficult deposits and the efforts in prolonging the working life of an enterprise by further successful coal mining are the most important aspects of technology, it is the main task of the commercial side to meet the financial requirements of the enterprise by securing optimal proceeds. The reliable organizational structure of an easily controllable enterprise which is not too large and the proved availability of all components have led to the successes of the past 35 years. Maintaining the continuity of this

development means marching at the top of progress also in the future.

0130 Transport And Handling

19657 **(CONF-840577—1) Performance characteristics of a capacitive mass flowmeter in a coal-oil slurry at the ANL Solid/Liquid Test Facility.** Bobis, J.P.; Brewer, W.E.; Raptis, A.C. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006422.

From 30. international instrumentation symposium; Denver, CO, USA (7 May 1984).

This paper describes the performance of the Argonne National Laboratory (ANL) capacitive flowmeter, a nonintrusive flow instrument with no moving parts, in measuring particle velocity and particle concentration during a series of coal-oil slurry tests at the ANL Solid-Liquid Test Facility (SLTF). The experiment measured mass flow by the capacitive flowmeter in a coal-oil slurry for particle velocities and coal concentrations ranging respectively from 0.4 to 3.7 m/s and 0 to 60 wt % under controlled and reproducible conditions. Measured results, with the capacitive flowmeter located in a vertical pipe run, are compared with the SLTF flow calibration facilities. It is demonstrated that the capacitive flowmeter successfully measured the average slurry density and provided a measure of the slurry velocity, by using the cross-correlation method, for all coal concentrations with several electrode configurations.

19658 **(CONF-8303136—) Railroad-slurry pipeline meeting.** (Virginia Coal Council, Richlands (USA)). 1983. 114p. NTIS, PC A06/MF A01. Order Number DE84900865.

From Railroad slurry pipeline meeting; Richlands, VA, USA (31 Mar 1983).

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Shipment of coal via slurry pipeline as an alternative to rail transport is the main topic of this meeting. The economics and other benefits from this operation are discussed. Problems of eminent domain and water requirements are addressed. A discussion of slurry legislation in Congress is presented. (DMC)

19659 **(DOE/MC/14603—1562) Conspray dynamic sleeve piston coal feeder. Phase II. Verification tests. Final technical report.** (Conspray Construction Systems, Inc., Santa Ana, CA (USA)). 26 Jan 1984. Contract AC21-80MC14603. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84007583.

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This report details the performance of Phase II: Verification Tests of the Conspray dynamic sleeve piston coal feeder. The machine performed for 200 hours at 700 psi backpressure, utilizing a 70% to 200 mesh Utah bituminous coal as feedstock. All test work was satisfactorily completed. A post-test inspection was performed. A report of component wear and failures incurred in testing is included as well as suggestions for machine upgrades. The overall conclusion is that the dynamic sleeve piston feeder has proven its ability to operate safely and reliably. When problems have occurred, the machine has demonstrated inherent safety by shutting down without endangering process or personnel. With the recommended improvements incorporated into the feeder, the unit will be ready for installation on a pilot scale coal gasifier. 9 figures, 11 tables.

19660 **(DOE/MC/19299—1564) Development of a pilot-scale kinetic extruder feeder system and test program. Phase II. Verification testing. Final report.** (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA (USA). Energy Systems). 12 Jan 1984. Contract AC21-82MC19299. 261p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84007356.

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This report describes the work done under Phase II, the verification testing of the Kinetic Extruder. The main objective of the test program was to determine failure modes and wear rates. Only minor auxiliary equipment malfunctions were encountered. Wear rates indicate useful life expectancy of from 1 to 5 years for wear-exposed components. Recommendations are made for adapting the equipment for pilot plant and commercial applications. 3 references, 20 figures, 12 tables.

19661 **(DOE/PC/40807—T9) Hydrocyclone separation of coal refuse fines.** Clendenin, H.B. (Southern Illinois Univ., Carbondale (USA). Dept. of Engineering Mechanics and Materials). Dec 1983. Contract FG22-81PC40807. 221p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84010077.

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The following conclusions are drawn from the research reported herein: (1) The experimental hydrocyclone apparatus, designed to allow control of the vortex finder length, overflow diameter, underflow diameter, cone angle, and inlet flow rate, is a suitable system for determining the effect of each variable stated on the washing of coal refuse fines. (2) Color-coded spheres of different diameters and specific gravities correlate well as a model of coal refuse fines in the range of 0.0937 inches and larger, insofar as their size and density responding to hydrocyclone separation. (3) Data taken on two experimental systems, using coal refuse fines samples from a gob pile, verify the dimensional analysis by their good correlation. The data collected can be assumed as a guide to geometrically similar hydrocyclones of different sizes. (4) The concentration of solids used during this work was not investigated but is considered a variable of importance in application. (5) Using the experimental hydrocyclone system and spheres along with the concepts of dimensional analysis and similitude, design curves can be generated showing the effect of each parameter on specific gravity separation. (6) Based on the guidance of the design curves, and confirmed by experimentation, a hydrocyclone configuration is recommended for separation of coal refuse fines. (7) Small changes in the vortex finder length causes significant changes in the specific gravity of solids reporting to the overflow. (8) Gob should be prescreened to remove clay. At that time the undersize material should be sent to a settling pond to be handled as settling pond fines if handled any more at all. 22 references, 44 figures, 16 tables.

19662 **(EPRI-CS—3374-Vol.1) Coal-water-slurry technology development. Volume 1. Burner technology. Final report.** Smith, D.A.; Rini, M.J.; LaFlesh, R.C.; Marion, J.L. (Combustion Engineering, Inc., Windsor, CT (USA). Kreisinger Development Lab.). Feb 1984. 213p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

A commercial-scale coal-water slurry (CWS) burner was developed and test fired. This atomizer and burner system was developed in three steps: (1) Atomizer development and optimization using optical measurement techniques; (2) Burner air register development using cold flow modeling, and (3) Full scale (80 MBtu/h) combustion testing of the atomizer and air register. Approximately 20,000 gallons of CWS were fired, parent coal was also fired, as pulverized coal, to provide a direct comparison with CWS. Combustion tests show that CWS can be successfully fired with carbon conversion efficiencies of approximately 98%, which is about 1% less than that for the parent coal. Carbon conversion efficiency for CWS was found to be strongly dependent on atomization quality; smaller droplets improved efficiency. Firing CWS, the burner was operated over a 4 to 1 turn-down range, but at low load, high excess air levels (approximately 50%) were needed to maintain satisfactory flame quality. NO/sub x/ emission for CWS firing were comparable to the parent coal at high loads but lower (by 50 to 150 ppM) at reduced loads. In addition to documenting the CWS firing system's combustion performance, useful information has been obtained on slurry storage, transport, handling, and atomizer erosion. 16 references, 97 figures, 14 tables.

19663 **(EPRI-CS—3413-Vol.1) Coal-water-slurry evaluation. Volume 1. Laboratory tests. Final report.** Daley, R.D.; Farthing, G.A.; Vecci, S.J. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). Feb 1984. 281p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

This is the first of three volumes describing the multi-phase coal-water slurry (CWS) test program. This volume contains the guideline CWS specifications and suggested test procedures for CWS characterization. The guideline specifications are generic and

are not boiler or site specific. The specifications address CWS solids content, viscosity, amount of material less than 200-mesh (75 microns), amount of material greater than 50-mesh (300 microns), volatile matter content, and sodium content of the ash. The suggested analytical test methods are summarized including special test modifications or comments as specifically related to CWSs. The detailed analytical test procedures for CWSs are also presented in appendix A. For completeness, detailed analytical test procedures for coal characterization are also provided in appendix B. This volume also includes an Executive Summary and description of the overall test program. 5 figures, 2 tables.

19664 **(EPRI-CS—3413-Vol.2) Coal-water-slurry evaluation. Volume 2. Laboratory and combustion test results. Final report.** Daley, R.D.; Farthing, G.A.; Vecci, S.J. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). Feb 1984. 240p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

This is the second of three volumes describing a multi-phase coal-water slurry (CWS) test program. This volume presents the results of laboratory, atomization, and combustion tests which were performed on six slurries and their parent coals. The objectives of these tests was to establish laboratory test procedures for evaluating CWS fuels, to investigate relationships between laboratory properties and CWS combustion and handling characteristics and to develop preliminary guidelines for CWS specifications. These tests showed that the preparation processes and chemical additives used by the slurry manufacturers had a significant effect on viscosity and atomization properties. The most important factor for good combustion performance was droplet size, but droplet size did not correlate with viscosity measured at low shear rates in the laboratory tests. It was also found that some slurries had greater fouling potential than their parent coals due to the use of sodium-containing additives. Tests were also conducted to determine whether the slurries could be transported and stored without coal settling. These tests showed that little settling occurred during either transportation or storage for at least three weeks. 98 figures, 27 tables.

0140 Combustion

REFER ALSO TO CITATION(S) 19662, 19663, 19664, 20454

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 19609, 19612, 19656, 20336

19665 **(DOE/AD/11151—T1) Effect of US coal exports on domestic economic growth and on US national security.** (Faucett (Jack) Associates, Inc., Chevy Chase, MD (USA)). Jan 1984. Contract AM01-81AD11151. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84009398.

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Possible US policies designed to increase US coal exports and the international coal trade are explored as they benefit the US economy and improve the US strategic position by decreasing the dependence of our allies and less developed countries on oil and gas from OPEC and Communist countries. In 1982 US coal exports to countries other than Canada totaled 88 million tons and supported about 39,000 miners and administrative employees, concentrated largely in Southern Appalachia. Total employment generated by these exports is estimated at about 150,000 jobs with income of 3.8 billion dollars. Local and state tax payments are estimated at 238 million dollars in 1982, including property, severance and income taxes. Policies that encourage substitution of imported coal for imported oil or natural gas will benefit US coal exports. Such policies also will benefit the US strategic position by decreasing the foreign influence on oil importers. Policies which encourage the development and use of indigenous coal in developing countries also will benefit the strategic position of the United States for the same reason. The report considers policies which are applicable to: (1) the developed nations of the world that lack sufficient coal resources of their own; (2) the developing nations that have adequate coal reserves that can be developed; and (3) the developing nations that do not have sufficient indigenous coal. Nations are listed for each category, and policies are presented for a case study country each category. Italy, Colombia, and the Republic of Korea were chosen for the case studies. For each country the report: summarizes the historical economic situation; presents historic sources of energy and patterns of energy demand; projects future energy supply and demand; describes national energy policies; and presents possible US energy policies concerning each nation.

19666 **(EAS-G—4) Organisation and structure of the Pacific steam coal trade.** Gaskin, M. (International Energy Agency Coal Research, London (UK). Economic Assessment Service). Oct 1983. 84p. International Energy Agency Coal Research, London (UK). Economic Assessment Service.

The report examines the modern steam coal trade between the Pacific Rim countries; it focuses on institutional structure, the organisation and commercial practices of the trade (including contract agreements) and the functioning of the regional market. It concludes that companies involved in this trade should be kept as free as possible from external constraints and co-ordinated purchasing, to allow a more efficient development of relationships to accomodate fluctuating problems of supply and demand. The report also argues that it is important to maintain the number of independent bargaining units and to avoid coordinated buying practices which could lead to bilateral bargaining by national groupings. However, this does not rule out cooperation between producers and consumers to meet demand. (32 refs.)

02 PETROLEUM

0202 Geology And Exploration

19667 **(DOE/EIA—0435) Petroleum resources of Libya, Algeria, and Egypt. Foreign energy supply assessment series.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Mar 1984. 194p. NTIS, PC A09/MF A01 - GPO; GPO Dep. Order Number DE84010036.

Part 1 of the report is a synopsis of each country's location, its exploration and development history, crude oil field production history, and markets. Part 2 discusses the production and reserve characteristics of the oil fields and status of the known crude oil resources. Part 3 provides an assessment of the ultimately recoverable crude oil and the possible future rate of availability of the crude oil. Part 4 discusses the status of the known and undiscovered natural gas resources, production, and markets. Part 5 is an overview of the petroleum geology of the three countries and the physical characteristics of their crude oils. Appendix A presents an annual resume of historical production by field and by basin for Libya; Appendix B shows the historical production by field and by basin for Algeria; Appendix C shows the historical production by field and by basin for Egypt; Appendix D provides production tables for each country. Data presented in Appendixes A through D are derived mostly from the April 1982 publication, Libya, Algeria and Egypt-Crude Oil Potential From Known Deposits DOE/EIA-0338, by William D. Dietzman, Naim R. Rafidi, and Thomas A. Ross. Appendix E is a geologic timetable.

19668 **Evolution of salt structures, East Texas Diapir Province, Part 1: Sedimentary record of Halokinesis.** Seni, S.J.; Jackson, M.P.A. (Bureau of Economic Geology, The Univ. of Texas at Austin, Austin, TX). *AAPG Bulletin;* **67**: No. 8, 1219-1244(Aug 1983). Contract AC97-80ET46617.

Post-Aptian (post-112Ma) strata in the East Texas basin were strongly influenced by halokinesis and therefore record the evolution of associated salt structures. Domeinduced changes in patterns of sandstone distribution, depositional facies, and reef growth indicate that thickness variations in strata surrounding domes were caused by syndepositional processes rather than by tectonic distortion. Salt domes in the East Texas basin exhibit three stages of growth: pillow, diapir, and post-diapir, each of which affected surrounding strata differently. Pillow growth caused broad uplift of strata over the crest of the pillows; the resulting topographic swell influenced depositional trends and was susceptible to erosion. Fluvial channel systems bypassed pillow crests and stacked vertically in

primary peripheral sinks on the updip flanks of the pillows. Diapir growth was characterized by expanded sections of shelf and deltaic strata in secondary peripheral sinks around the diapirs. Lower Cretaceous reefs on topographic saddles between secondary peripheral sinks now host major oil production at Fairway field. Post-diapir crestal uplifts and peripheral subsidence affected smaller areas than did equivalent processes during pillow or diapir stages. Documented facies variations over and around domes at different stages of growth enable prediction of subtle facies-controlled hydrocarbon traps. Facies-controlled traps are likely to be the only undiscovered ones remaining in mature petroliferous basins such as the East Texas basin.

19669 **Evolution of salt structures, East Texas Diapir Province, Part 2: patterns and rates of Halokinesis.** Seni, S.J.; Jackson, M.P.A. (Bureau of Economic Geology, The Univ. of Texas at Austin, Austin, TX). *AAPG Bulletin;* **67**: No. 8, 1245-1274(Aug 1983). Contract AC97-80ET46617.

The effects of salt mobilization on Aptian and younger (post-112 Ma) strata in the East Texas basin can be used to illustrate patterns of dome growth through time, and to estimate rates and amounts of salt movement. Pre-Aptian domes grew in three areas around the margin of the diapir province, apparently in pre-Aptian depocenters. Maximum dome growth along the basin axis coincided with maximum regional sedimentation there during the middle Cretaceous (Aptian, Albian, and Cenomanian). In the Late Cretaceous the sites of maximum diapirism migrated to the periphery of the diapir province. Diapirism began after pillows were erosionally breached, leading to salt extrusion and formation of peripheral sinks. The duration of pillow and diapir stages of growth was subequal, ranging from 10 to 30 Ma. Post-diapiric stage of growth continued for more than 112 Ma in some cases. Diapirs grew fastest in the Early Cretaceous, when peak growth rates ranged from 150 to 530 m/Ma (490 to 1,740 ft/Ma), declining in the Early Tertiary to 10 to 60 m/Ma (30 to 200 ft/Ma). Assuming steady-state conditions over periods of 1 to 17 Ma, strain rates for the rise of the East Texas diapirs averaged 6.7 X 10^{-16}/sec; peak gross rate of growth averaged 2.3 X 10^{-15}/sec, similar to slow orogenic rates. The evolution of East Texas salt domes essentially ended in the early Tertiary with uplift rates less than 30 m/ Ma (100 ft/Ma).

0203 Drilling And Production

19670 **(DOE/BC/10116—26) Flow in porous media, phase behavior and ultralow interfacial tensions: mechanisms of enhanced petroleum recovery. Final technical report.** Davis, H.T.; Scriven, L.E. (Minnesota Univ., Minneapolis (USA). Inst. of Tech.). 1982. Contract AC19-79BC10116. 426p. NTIS, PC A19/MF A01; GPO Dep. Order Number DE84009783.

A major program of university research, longer-ranged and more fundamental in approach than industrial research, into basic mechanisms of enhancing petroleum recovery and into underlying physics, chemistry, geology, applied mathematics, computation, and engineering science has been built at Minnesota. The 1982 outputs of the interdisciplinary team of investigators were again ideas, instruments, techniques, data, understanding and skilled people: forty-one scientific and engineering papers in leading journals; four pioneering Ph.D. theses; numerous presentations to scientific and technical meetings, and to industrial, governmental and university laboratories; vigorous program of research visits to and from Minnesota; and two outstanding Ph.D.'s to research positions in the petroleum industry, one to a university faculty position, one to research leadership in a governmental institute. This report summarizes the 1982 papers and theses and features sixteen major accomplishments of the program during that year. Abstracts of all forty-five publications in the permanent literature are appended. Further details of information transfer and personnel exchange with industrial, governmental and university laboratories appear in 1982 Quarterly Reports available from the Department of Energy and are not reproduced here. The Minnesota program continues in 1983, notwithstanding earlier uncertainty about the DOE funding which finally materialized and is the bulk of support. Supplemental grants-in-aid from nine companies in the petroleum industry are important, as are the limited University and departmental contributions. 839 references, 172 figures, 29 tables.

19671 **(EPRI-EM—3424-Vol.4) Cogeneration systems design for enhanced oil recovery. Volume 4. Appendixes to Volume 2. Final report.** Boyen, J.L.; Waters, M.H.; Rodden, R.M.; Schuler, C.J. (RMR Associates, Palo Alto, CA (USA)). Mar 1984. 267p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

This abstract covers the fourth volume of a four volume final report on Electric Power Research Institute project RP 1276-9, Cogeneration Systems Design for Enhanced Oil Recovery. This volume provides supporting appendices for Volume II, which presents preliminary design and other information for an enhanced oil recovery system to be used at an oil producing site operated by Tosco Corporation in southern California. The principal goal of the project was to provide the oil producers and utility companies with conceptual designs and cost estimates for cogeneration systems that could produce both steam for enhanced oil recovery and electric power. Appendix A presents results obtained from further study of the Tosco site nonretrofit option, the Gas Turbine-Heat Recovery Boiler system, which is based on all new equipment. Appendix B provides additional information on the Conventional Boiler Retrofit system using both direct air and indirect air and on the potential for increased power output through the use of a topping steam turbine. Appendix C describes a control system design concept for the Gas Turbine-Heat Recovery Boiler system, which with modification could be made applicable to the Conventional Boiler Retrofit system also. Appendix D presents the financial methodology, model description, and graphical and statistical financial details on the two systems. 1 reference, 42 figures, 11 tables.

19672 **Numerical solution for height and elongated hydraulic fractures.** Palmer, I.D.; Carroll, H.B. (Oral Roberts Univ.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 11627**: 249-256(Mar 1983). (CONF-830305—).

From SPE symposium on low permeability; Denver, CO, USA (14 Mar 1983).

The authors are developing a simplified model of hydraulic fracture expansion which can predict height growth and bottomhole pressure behavior as a function of time when a blanket sand is stimulated. Leakoff is included. Illustrative results have been presented. The main limitation is that the height growth must be slow compared with the length extension (i.e., elongated fractures with aspect ratio about 5). At present the model works in a three-layer case in which the higher bounding stresses are symmetric about the payzone. This is being extended to the case in which the stresses are asymmetric. Meanwhile, an approximate solution is available when the asymmetric bounding stresses are not too different, but leakoff is not included. This has been used above to estimate fracture height growth in the Cozzette sand which will be stimulated as part of the Multi-Well Experiment.

19673 **Comparison of the fracture conductivity of commercially available and experimental proppants at intermediate and high closure stresses.** Cutler, R.A.; Carroll, H.B.; Enniss, D.O.; Jones, A.H. (Terra Tek Inc.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 11634**: 305-318(Mar 1983). (CONF-830305—).

From SPE symposium on low permeability; Denver, CO, USA (14 Mar 1983).

A laboratory comparison of fracture conductivity versus closure stress was performed on eight commercially available and four experimental prototype proppant materials. Ottawa sand and bauxite, both widely accepted and applied proppants, were included in the study as performance standards. Consistent sample preparation, test, and data reduction procedures were practiced and allow a relative comparison of the conductivity of various proppants at intermediate and high stresses. Specific gravity, corrosion resistance and crush resistance of each proppant were also determined. Proppant materials were supplied by major domestic and international proppant manufacturers. All were carefully screened and sized to obtain nearly identical -20,+40 mesh size distributions. Fracture conductivity was measured to a laminar flow of deaerated, deionized water over a closure stress range of 6.9 MPa (1,000 psi) to 96.5 MPa (14,000 psi) in 6.9 MPa (1,000 psi) increments. Testing was per-

formed at a constant 50°C (122°F) temperature. Results of the testing are compared with values from the literature and analyzed to determine proppant acceptability in the intermediate and high closure stress regions. Recommendations are made for proppants that will perform acceptably at low, intermediate and high closure stresses.

0204 Processing

19674 **(DOE/BC/10349—1) Evaluation of heavy oil upgrading/refining process designs for HRI Dynacracking and UOP Aurabon Process. Final report.** Davis, H.; Adams, D.G.; Fox, J.V. (Walk-Haydel and Associates, Inc., New Orleans, LA (USA); BDM Corp., Albuquerque, NM (USA)). Apr 1984. Contract AC19-81BC10349. 148p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84008984.

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The process designs examined consist of two non-commercialized heavy oil upgrading processes; namely, the Hydrocarbon Research, Inc. (HRI) Dynacracking Process and the UOP Process Division (UOP) Aurabon Process. The latter process design includes, besides the Aurabon Process, an integrated hydrotreating section which does have commercial stature. The Dynacracking Process designs cover six cases involving three heavy crude feedstocks. The Aurabon Complex designs are based on four cases, two for each of two heavy crude feedstocks. The engineering support services involved engineering review and assessment of data, drawings, reports and other information generated by the two process designers. Background information, the review and assessment methodology employed for evaluating the process designs, and a detailed discussion of the process design data generated by both process contractors are presented in this report. Significant findings for both processes may be summarized as follows: (1) The process designs were executed using sound engineering principles and practices; (2) Both processes may be deemed to perform in accordance with their process design; (3) a wide variety of heavy oil charge stocks can be upgraded by either process to products generally suitable for further refinery processing; (4) no insurmountable operating or environmental problems are anticipated; (5) the estimated capital investments and operating utility requirements are indicative of the increased cost to process contaminated heavy crudes; (6) the cost differential between the higher quantity lighter crudes and the poorer quality heavy crudes must be sufficient to justify these higher expenditures; and (7) both processes merit consideration by refiners contemplating contaminated heavy oil upgrading. 53 references, 40 tables.

19675 **Catalytic hydrotreating of 1-Methylnaphthalene as a screening test. II.** Chien, P.L.; Sellers, G.M.; Weller, S.W. (Department of Chemical Engineering, State University of New York at Buffalo, Amherst). *Fuel Processing Technology;* 7: No. 1, 1-9(Jan 1983).

Eight $Co/Mo/Al_2O_3$ catalysts from commercial suppliers, along with $SnCl_2$, have been studied for the hydrotreating of 1-methylnaphthalene (1-MN) in a stirred autoclave at 450 and 500°C. The predominant catalyzed reaction at 450°C is ring hydrogenation (RHG); at this temperature hydrodemethylation (HDM) is appreciable but little affected by catalysts, and ring hydrocracking (RHC) is very low. With presulfided catalysts at 500°C, HDM predominates and RHC becomes appreciable; the extent of RHG is much less at 500° than at 450°C. $SnCl_2$ slightly catalyzes HDM, but it is a very poor catalyst for both RHG and RHC. The RHG activity is much greater at 450°C for all the presulfided catalysts than for the as-received ones. Final autoclave pressure correlates well with the extent of 1-MN conversion by RHG and RHC.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 19671, 19683, 20310, 20311

19676 **(DOE/EI/10323—T1) [Gasoline survey tables]. Final report.** (Bureau of the Census, Washington, DC (USA)). 16 Apr 1982. Contract AI01-80EI10323. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84010149.

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Revised data for 1978 to 1981 are contained in the enclosed tables. No significant change between the new and old sample results for sales and inventories. Revised establishment count estimates in January 1982 totalled 142,600, about 0.8% lower than old sample results. Estimates of gasoline gallons sold in January 1982 were revised to 5.4 billion, about 1.6% higher than the old survey. The dollar value of gasoline sold was revised to $7.1 billion, about 1.4% higher than information given earlier. The derived gasoline price per gallon from the new sample estimates was $1.316, about 0.2% lower than the previous figure of $1.318. Larger differences are found in estimates of diesel fuel and gasohol sales. We believe that these differences are caused by generally more complete reporting by the new panels of respondents, by classification improvements resulting in better representation of truck stop operations, and also by sample variability in the relatively small estimates of these specific fuel types. Even larger differences appear in estimates tabulated by type of operation. These figures are often based on sample observations in a given month and no statistical significance is attributed to the results.

19677 **(DOE/EIA—0035(83/12[4])) Monthly energy review, December 1983 [4]. 1983 annual data and summaries.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Mar 1984. 120p. NTIS, PC A06/MF A01 - GPO; GPO Dep. Order Number DE84010030.

Energy production during December 1983 totaled 5.3 quadrillion Btu, a 2.5% increase compared to the level of production during December 1982. While petroleum production fell 0.5%, coal production increased 2.9%, and natural gas production was up 2.3%. Production of all other forms of energy combined increased 11.3% compared to production 1 year earlier. Energy consumption during December 1983 totaled 7.2 quadrillion Btu, 13.7% above the level of consumption during December 1982. Natural gas consumption increased 22.4%, coal consumption was up 15.2%, and petroleum consumption increased 7.7%. Consumption of all other forms of energy combined increased 10.8% compared to consumption during December 1982. Net imports of energy during December 1983 totaled 0.7 quadrillion Btu, 15.3% above the level of imports during December 1982. Net imports of petroleum increased 16.1%, while net imports of natural gas decreased 3.8%. Net exports of coal were up 3.3% compared to the level in December 1982.

19678 **(DOE/EIA—0109(84/01)) Petroleum supply monthly, January 1984.** (USDOE Energy Information Administration, Washington, DC). Mar 1984. 99p. NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84009978.

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This issue reflects changes in the Petroleum Supply Reporting System that became effective January 1984. Resultant changes to tables published herein are described. Also featured are two articles relating to petroleum consumption. 12 figures, 30 tables.

19679 **(DOE/RG/06624—T1) Propane consumption and retail pricing procedures in Minnesota. Final review.** Nelson, S.P. (Minnesota Energy Agency, St. Paul (USA)). 22 Jun 1979. Contract FG01-78RG06624. 92p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84010165.

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This report has three principal objectives. The first and most important is to determine and quantify the extent to which conservation of propane by residential consumers is hindered by pricing structures which require small volume users to pay more for their fuel than larger users. The second objective was to develop esti-

mates of propane sales within each of the thirteen Minnesota development regions by end user groups. The third objective was to develop price and transportation cost information for propane shipped into the state from gas producing regions, particularly western Canada. This summary reports the results of our investigation, particularly with regard to the propane pricing/conservation concern.

0209 Environmental Aspects

19680 (AD-P—002006/5) Monitoring marine pollution by airborne remote sensing techniques. Yuanfu, S.; Quanan, Z. (Fiat Auto Spa, Turin (Italy)). Jun 1982. 10p. NTIS, PC A02/MF A01.

In order to monitor marine pollution by airborne remote sensing techniques, some comprehensive test of airborne remote sensing, involving monitoring marine oil pollution, were performed at several bay areas of China. This paper presents some typical results of monitoring marine oil pollution. The features associated with the EM spectrum (visible, thermal infrared, and microwave) response of marine oil spills is briefly analyzed. It has been verified that the airborne oil surveillance systems manifested their advantages for monitoring the oil pollution of bay environments.

19681 (AD-P—002013/1) Preliminary field tests with oil slicks using microprocessor controlled microwave radiometer system. Laeaeperi, A. (Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.). Jun 1982. 5p. NTIS, PC A02/MF A01.

This paper discusses the two-channel microprocessor controlled microwave radiometer system developed at the Radio Laboratory of the Helsinki University of Technology for oil thickness measurements. The thickness estimations are based on the actual antenna brightness temperatures in real time seen by the two radiometers. For this reason great care has been taken to achieve stable radiometer system. The effects of weather conditions are eliminated by storing the brightness temperature values from a clean water surface into the memory to be used as reference values for thickness measurements. However, the weather and the sea state have great influence on the behaviour of the oil slick and for this reason quite low references, 5 GHz and 16.5 GHz, are selected for the radiometers. This means that the thickness estimations are possible up to 10 mm with an accuracy of 1 mm using the 5 GHz radiometer and up to 3 mm with an accuracy of 0.2 mm using the 16.5 GHz radiometer. Finally, some experimental results from field tests are explained.

19682 (FERC/EIS—0016) Zachary-Fort Lauderdale pipeline construction and conversion project: final supplement to final environmental impact statement. Docket No. CP74-192. (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Pipeline and Producer Regulation). May 1980. 347p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84009437.

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This Final Supplement to the Final Environmental Impact Statement (Final Supplement) evaluates the economic, engineering, and environmental aspects of newly developed alternatives to an abandonment/conversion project proposed by Florida Gas Transmission Company (Florida Gas). It also updates the staff's previous FEIS and studies revisions to the original proposal. Wherever possible, the staff has adopted portions of its previous FEIS in lieu of reprinting portions of that analysis which require no change. 60 references, 8 figures, 35 tables.

0210 Legislation And Regulation

19683 (DOE/RG/06598—T1) Energy Emergency Handbook. (USDOE Economic Regulatory Administration, Washington, DC). 1979. Contract AC01-78RG06598. 303p. NTIS, PC A14; 3; GPO Dep. Order Number DE84008344.

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This Handbook identifies selected state and Federal measures available to mitigate the impact of an energy emergency, and provides a comprehensive energy emergency communications directory. In the case of state remedial actions, particular emphasis has been placed on typical implementation procedures and likely impacts. The discussions of Federal actions focus on initiation and implementation procedures. The directory is designed to facilitate communications of all types (telephone, Telex, TWX, or facsimile) among key energy emergency officials in the Federal and state governments.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 19682

0230 Properties

19684 (NIPER—133-PPS-84/1) Motor gasolines, summer 1983. Shelton, E.M. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Feb 1984. Contract FC01-83FE60149. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008980.

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The samples were collected from service stations throughout the country and were analyzed in the laboratories of various refiners, motor manufacturers, chemical companies, and research institutes. The analytical data for 1583 samples of motor gasoline, were submitted to the National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma for study, necessary calculations, and compilation under a cooperative agreement between the National Institute for Petroleum and Energy Research (NIPER) and the American Petroleum Institute (API). They represent the products of 48 companies, large and small, which manufacture and supply gasoline. These data are tabulated by groups according to brands (unlabeled) and grades for 17 marketing districts into which the country is divided. A map included in this report, shows marketing areas, districts and sampling locations. The report also includes charts indicating the trends of selected properties of motor fuels since 1959. Sixteen octane distribution percent charts for areas 1, 2, 3, and 4 for unleaded antiknock index (R+M)/2 below 90.0, unleaded antiknock index (R+M)/2 90.0 and above, and leaded antiknock index (R+M)/2 below 93.0 grades of gasoline are presented in this report. The antiknock (octane) index (R+M)/2 averages of gasoline sold in this country were 87.5 for unleaded below 90.0, 91.4 for unleaded 90.0 and above, and 89.0 for leaded below 93.0 grades of gasoline. 16 figures, 5 tables.

0240 Storage

19685 (SAND—83-0347) Experimental studies of oil withdrawal from salt cavities via fresh-water injection. Reda, D.C.; Russo, A.J. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1984. Contract AC04-76DP00789. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010106.

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The US Strategic Strategic Petroleum Reserve (SPR) program coordinates the storage of crude oil in underground salt caverns. Oil removal from these caverns will be accomplished by injecting water into a brine volume located beneath the oil, buoyantly displacing the oil upwards, where it will then be recovered through a production pipe located near the top of the cavern. The critical question was whether or not the crude oil would protect the salt walls from dissolution upon exposure to unsaturated brine following oil/brine interface passage. These oil/brine/salt interactions were experimentally investigated in the laboratory. Cylindrical cavities were created by machining (hollowing-out) salt cores from one end, leaving the circular wall and bottom as an integral piece. In each of four separate experiments, a salt cavity was placed vertically in a pressure vessel and its interior filled with crude oil overlying a saturated-brine picket. The vessel was sealed and pressurized to actual SPR-cavern pressure. Fresh water was injected down a tube and into the brine pocket, displacing the coil upwards, where it was recovered from the cavity through a second (production) tube near the top of the vessel. A traversable gamma-beam densitometer was

positioned above the initial saturated-brine/oil interface and was used as a non-intrusive diagnostic to define the presence, or absence, of salt dissolution (cavity shape change) during the transient oil-withdrawal process. Such measurements showed the occurrence of salt-wall recession following interface passage in all tests, i.e., crude-oil adherence, and/or penetration, at the salt wall failed to protect the salt from dissolution upon its exposure to unsaturated brine. Measured post-test cavity shapes corroborated the transient results. Both transient and steady-state measurements were found to be in good agreement with numerical predictions. 15 references, 16 figures, 1 table.

03 NATURAL GAS

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 19667, 19668, 19669, 19692, 19693

19686 **(SAND—83-2469C) Pressure core measurements in tight sandstone lenses during the multi-well experiment.** Sattler, A.R.; Heckes, A.A.; Clark, J.A. (Sandia National Labs., Albuquerque, NM (USA); Calvin Coll., Grand Rapids, MI (USA)). May 1984. Contract AC04-76DP00789. 11p. (CONF-8405120—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009095.

From SPE/DOE/GRI gas recovery symposium; Pittsburgh, PA, USA (13 May 1984).

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A pressure coring operation was performed in two tight sandstone lenses of the Mesaverde group during the drilling of one well of DOE's Multi-Well Experiment. The goals were: (1) to obtain accurate water saturation data; (2) to measure the amount and composition of gas on a foot-by-foot basis; and (3) to recover fluids for water chemistry analysis. This application of pressure coring had not been tried before; it was felt to be the best approach for accurate water saturation measurements in tight sandstone core. Several changes to usual pressure coring procedures were adopted. These included the development of an organic noninvasive coring fluid, compatible with the oil-based drilling fluid used that would help preserve water saturation. Three 15-ft pressure core barrels were taken in two sandstone lenses 20 and 30 ft thick; all three barrels were filled with sandstone. Goals 1 and 2 were met. Water saturation values are reported and discussed. The type and duration of the water extraction processes are shown to be very important in determining water saturations in tight sands. Gas species and amount are available on a foot-by-foot basis. 4 references, 1 figure, 5 tables.

19687 **(SAND—84-0543C) Multi-Well Experiment core program, II.** Sattler, A.R. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 8p. (CONF-8405120—2). NTIS, PC A02; GPO Dep. Order Number DE84008335.

From SPE/DOE/GRI gas recovery symposium; Pittsburgh, PA, USA (13 May 1984).

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An unprecedented core analysis program is under way as part of DOE's Multi-Well Experiment (MWX). MWX is a research-oriented field laboratory whose objectives are to thoroughly characterize lenticular tight gas sands and to develop technology for their production. Over 4100 ft (1250 m) of core were taken from three wells separated by only about 115-215 ft (35 to 66 m) at depth. All major categories of core analysis are reviewed and results through December 1983 are included. Those includ routine core analysis, restored state reservoir parameter measurements, electrical measurements, mechanical rock property data, mineralogy, organic maturation, natural fractures, and geochemistry. This paper also describes the laboratory work on core and formation invasion and the development of instruments that were used in the field processing of the core. 93 references.

19688 **Fluid flow in cracks as related to low permeability gas sands.** Brower, K.R.; Morrow, N.R. (New Mexico Inst. of Mining Technology). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 11623**: 201-212(Mar 1983). (CONF-830305—). Contract AS19-80BC10216.

From SPE symposium on low permeability; Denver, CO, USA (14 Mar 1983).

A problem in formation evaluation of tight gas sands is that their permeabilities are sometimes surprisingly sensitive to variations in overburden pressure. Photomicrographs of pore casts show an interconnected system of sheet pores which are somewhat like the surfaces of a randomized honeycomb. A mathematical relation for predicting the pressure dependence of flow rate in sheet pores has been derived from the dimensions of the pores and the elastic constants of the matrix. The equation has been validated by measurements on artificial media containing cracks of known dimensions in glass and concrete. The observed pressure sensitivity of the gas sands used in this study requires the aspect ratio of the pores (in this case, the ratio of average large dimension to sheet thickness) to be greater than 100. Aspect ratios have been determined by taking the large dimension from photomicrographs of pore casts or grain size and thickness from mercury injection pressure or from the slope of a plot of apparent permeability vs. the reciprocal of gas density. The latter gives the effusive contribution to gas flow from which the pore size can be calculated. The two methods for measuring pore size give satisfactory agreement. The aspect ratios for the sheet pores in tight gas sands are large enough to explain the dependence of permeability on overburden pressure.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 20311

19689 **(DOE/EIA—0130(84/01)) Natural gas monthly, January 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Mar 1984. 122p. NTIS, PC A06/MF A01 - GPO; GPO Dep. Order Number DE84009503.

(All comparisons represent a year earlier). Dry gas production during January 1984 was estimated at 1491 billion cubic feet (Bcf), 33 Bcf, 2.3%. Consumption of natural gas during January 1984 was an estimated 2064 Bcf, an increase of 88 Bcf (4.5%). Residential consumption in December 1983 was up 39.1%, commercial consumption was up 12.4%, industrial consumption was up 22.5%, and electric utility consumption was up 1.9%. The volume of working gas in underground storage reservoirs at the end of January 1984 was 21.0% lower. Net withdrawals from underground storage were 512 Bcf. The average wellhead price of natural gas in December 1983 was $2.58 per thousand cubic feet (Mcf), a drop of $.04 per Mcf. In January 1984, the average residential price of natural gas was $5.96 per Mcf, a rise of $.12 per Mcf. The average wellhead price for natural gas purchases projected for February 1984 by selected interstate pipeline companies was $2.88 per Mcf, an increase of $.15 per Mcf. The average price projected for Old Gas (NGPA Sections 104, 105, and 106) in February 1984 was $1.42 per Mcf; for New Gas (NGPA Sections 102, 103, 108, and 109), $3.57 per Mcf; and for High Cost Gas (NGPA Section 107), $5.94 per Mcf. In February 1983 the prices projected for Old Gas, New Gas, and High Cost Gas averaged $1.39, $3.32, and $6.73 per Mcf, respectively.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 19654

19690 **(DOE/MC/16015—1368-Vol.2) Chip desorption and pore structure effects in methane release from coal. Volume 2. Final report.** Williams, F.L. (New Mexico Univ., Albuquerque (USA). Dept. of Chemical and Nuclear Engineering). Jan 1983. Contract AC21-81MC16015. 381p. NTIS, PC A17/MF A01. Order Number DE83007256.

Volume two contains appendices for the following reports: (1) a new technique for determining the methane content of coal;

(2) the methane content of San Juan Basin Coal - implications for coalbed methane resource assessments; (3) diffusional effects in recovery of methane from coalbeds; (4) diffusional models for gas production from coal - application to methane content determination; (5) diffusion models for gas production from coal - determination of diffusion parameters; (6) the direct method of determining the methane content of coal - a modification; (7) methane recovery from coalbeds - effect of monolayer capacity and pore structure on gas content; and (8) methane diffusion and desorption in coal.

19691 **(SAND—83-2448C) Propellant-based technology for multiply fracturing wellbores to enhance gas recovery: application and results in Devonian shale.** Cuderman, J.F.; Northrop, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1984. Contract AC04-76DP00789. 17p. (CONF-8405120—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009063.

From SPE/DOE/GRI gas recovery symposium; Pittsburgh, PA, USA (13 May 1984).

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A propellant based technology has been developed that permits control of borehole pressurization to obtain multiple radial fractures about the wellbore. The objective is to connect nonintersecting natural fractures in a reservoir to the wellbore and thereby stimulate increase production. Techniques are presented for specifying the pressure pulse required for producing multiple fractures and for choosing propellants to achieve the desired pressure pulse. The multiple fracturing technique was specifically developed for application in naturally fractured Devonian shale gas reservoirs. A stimulation experiment in a Devonian shale gas well successfully increased production from 6700 ft ^{3}/day to 22,000 ft^3/day (190 m^3/day to 623 m^3/day). 16 references, 9 figures, 3 tables.

19692 **(SAND—83-2470C) Current status of the Multi-Well Experiment.** Northrop, D.A.; Sattler, A.R.; Mann, R.L.; Frohne, K.H. (Sandia National Labs., Albuquerque, NM (USA); CER Corp., Las Vegas, NV (USA); USDOE Morgantown Energy Technology Center, WV). 1984. Contract AC04-76DP00789. 18p. (CONF-8405120—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007575.

From SPE/DOE/GRI gas recovery symposium; Pittsburgh, PA, USA (13 May 1984).

The Multi-Well Experiment (MWX) is a research-oriented field laboratory whose objective is to develop the understanding and technology to allow economic production of the several years supply of natural gas estimated to be within the low permeability, lenticular gas sands of the Western United States. Features of MWX include: (1) three closely-spaced wells (115 to 215 ft, 35 to 66 m) for reservoir characterization, interference testing, well-to-well geophysical profiling, and placement of diagnostic instrumentation adjacent to the fracture treatment; (2) complete core taken through the formations of interest; (3) a comprehensive core analysis pr[illegible]; (4) an extensive logging program with conventional and experimental logs; (5) determination of in situ stresses in sands and bounding shales; (6) use of various seismic surveys and sedimentological analyses to determine lens morphology and extent; (7) use of seismic, electrical potential, and tilt diagnostic techniques for hydraulic fracture characterization; and (8) a series of stimulation experiments to address key questions. This paper presents the current MWX accomplishments resulting from the 1983 field season which featured the drilling of a third well and the first stimulation experiment. 15 references, 6 figures, 1 table.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 19682

0330 Properties

19693 **(DOE/MC/19239—1546) Handbook of gas hydrate properties and occurrence.** Kuustraa, V.A.; Hammershaimb, E.C. (Lewin and Associates, Inc., Washington, DC (USA)). Dec 1983. Contract AC21-82MC19239. 248p. NTIS, PC A11/MF A01; GPO Dep. Order Number DE84003080.

This handbook provides data on the resource potential of naturally occurring hydrates, the properties that are needed to evaluate their recovery, and their production potential. The first two chapters give data on the naturally occurring hydrate potential by reviewing published resource estimates and the known and inferred occurrences. The third and fourth chapters review the physical and thermodynamic properties of hydrates, respectively. The thermodynamic properties of hydrates that are discussed include dissociation energies and a simplified method to calculate them; phase diagrams for simple and multi-component gases; the thermal conductivity; and the kinetics of hydrate dissociation. The final chapter evaluates the net energy balance of recovering hydrates and shows that a substantial positive energy balance can theoretically be achieved. The Appendices of the Handbook summarize physical and thermodynamic properties of gases, liquids and solids that can be used in designing and evaluating recovery processes of hydrates. 158 references, 67 figures, 47 tables.

0340 Combustion

REFER ALSO TO CITATION(S) 20577

04 OIL SHALES AND TAR SANDS

0402 Site Geology And Hydrology

19694 **Northwest Asphalt Ridge tar sand deposit well logging and coring comparison.** Fahy, L.J.; Merriam, N.W.; Mones, C.G. (U.S. DOE, Laramie Energy Technology Center). pp 343-388 of Synthetic fuels from oil shale and tar sands. Chicago, IL; I.G.T. (1983).

Quantitative well logging techniques were performed on four LETC wells used to conduct a small scale tar sand steamflood and four additional wells used to provide reservoir data for the design of a fourth field experiment near Vernal, Utah. The purposes of this study were to: summarize and present the log derived information; determine how accurately the log data matched the core data; and estimate values for R /SUB w/ in the Rimrock Sandstone Member. A gamma, sidewall neutron, density, SP, induction and caliper log suite was utilized in determining porosity and water saturations. A sonic log was utilized in determining the elastic rock properties; pressure velocity, shear velocity, Young's modulus and Poisson's ratio. Carbon/oxygen logs were also run to determine hydrocarbon saturation. The density log was determined to be the best logging source of porosity. Crossplotting and shale corrections did not improve the porosity quality. Formation water resistivity was estimated from the Archie equation using the core porosity and water saturations and using the induction log formation resistivity. Generally, good porosity information was determined from the density log. Water saturations were acceptable but did not match the core data as well as desired. Elastic rock properties derived from the sonic logs also matched core derived values. Carbon/oxygen logs have proven to be a good method of detecting changes in formation oil saturation. Oil saturation values derived from the carbon/oxygen log may be conservative due to the lack of a clean unsaturated sandstone zone to use as a reference point.

19695 **Oil shale? Tar sand? There's a definite difference indeed.** Dana, G.F. (Laramie Energy Technology Center, Laramie, Wyoming). pp 11-38 of Synthetic fuels from oil shale and tar sands. Chicago, IL; I.G.T. (1983).

Deposits of both oil shale and tar sand are classified as unconventional sources and a number of dissimilarities exist in these two potentially developable commodities. The major differences are found in depositional environments, physical and chemical characteristics, kinds of organic matter and derived oils, and methods of extraction. Oil shale and tar sand deposits are not commonly found in the same localities but are scattered through parts of the United States. The principal exception is the Uinta Basin of Utah where major tar sand deposits are stratigraphically adjacent to and sometimes interbedded with oil shale.

19696 **Controlled source audio magnetotelluric (CSAMT) survey of steamflood in subsurface tar sands.** Wayland, J.R.; Lee, D.O.; Montoya, P.C. (Sandia National Laboratories, Albuquerque, NM 87185). pp 323-341 of Synthetic fuels from oil shale and tar sands. Chicago, IL; I.G.T. (1983).

A steamflood experiment, designated TS-1S, was conducted by U.S. DOE Laramie Energy Technology Center in the Northwest Asphalt Ridge Tar Sand. The later stages of this experiment were mapped at depth using the controlled source audio magnetotelluric (CSAMT) technique to assist in determining the location of the steam front. Normalized maps were produced which are consistent with the production data, temperature data from monitoring wells, and post test coring data. The results indicate that the CSAMT technique shows promise for monitoring thermal front locations.

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 19701, 21154

19697 **Vertical pneumatic conveying of mixed-particle-sized oil shale.** Schamaun, J.T. (Sandia National Laboratories, Albuquerque, NM). *Oil Shale Symposium Proceedings;* 437-450(Apr 1983). (CONF-830434—). Contract W-7405-ENG-48.

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Solid flow characteristics of mixed-sized oil shale in vertical pneumatic conveyers were investigated using a 47.6-mm-diameter lift-pipe. The shale was in a crushed and spent condition with a particle size range of 0.074 to 3.36 mm. Components of the pressure gradient in established flow were measured over a range of gas velocities and solid fluxes. Size-dependent particle velocities were also indirectly measured and shown to depend on solid flow rates. Particle velocity dependence is described by experimentally generated expressions for the range of particle sizes studied. In this system for conveying mixed-sized shale, particle velocities were found not to be predictable from terminal or free-fall velocities which were also measured. The aggregate solids velocity, which is computed from the single-sized particle-velocity relations, permits a reasonably accurate prediction of solids pressure drop. Use of a solids friction factor, estimation of choking velocity, and characteristics of the acceleration length are also discussed.

19698 **Effect of anisotropy in explosive fragmentation.** Dienes, J.K. (Univ. of California, Los Alamos). pp 177-183 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—).

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

An alternative to the use of the plasticity theories to characterize the dynamic behavior of rock is to represent the effect of flaws by statistical methods. We have taken such an approach to study the fragmentation of oil shale because it appears to have a large number of advantages. An attempt to formulate an isotropic statistical theory by Dienes (1978a) was abandoned because it could not incorporate the effects of shear cracks, which believe are important under compressive loading, and because it appears to be important to permit cracks with certain orientations to grow while others remain fixed in size. This is particularly the case in oil shale, in which bedding cracks play an important role. The current theory, which allows for an isotropic crack distributions, has now been coupled to the SALE hydrodynamic code, making it possible to compute explosion, impact or other dynamic processes. In addition to summarizing the theory, the object of this paper is to show that a spherical explosive calculation with SCRAM using published mechanical properties of oil shale agrees well with experiment.

19699 **Energy and particle size effects in the fragmentation of oil shale with a torsional split Hopkinson bar.** Grady, D.; Lipkin, J.; Costin, L. (Sandia National Lab., Albuquerque, NM). pp 193-198 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—). Contract AC04-76DP00789.

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

In the present work, a torsional split Hopkinson bar was used to conduct an experimental investigation of the particle size distribution and energy aspects of dynamic fragmentation of oil shale. Although recognized as being unrepresentative of explosive blasting the method allows for controlled experimentation in which input parameters can be accurately varied and output parameters, such as stress and strain, continuously resolved. Earlier studies by Lipkin and Jones with a torsional bar focused on the stress states achieved in dynamic fracture of oil shale and Gauna used a compressional split Hopkinson bar to study fracture energy requirements. In this study both strain rate and oil shale grade were varied to investigate the influence on the fracture energy. Fracture energies were determined with active instrumentation on the Hopkinson bar and standard sieving methods were used to evaluate the fragment size distributions. In section II the experimental approach and methods used to analyze the data are described. In section III the experiments conducted with various grades of oil shale are presented and the results for a specified oil shale grade loaded at different imposed strain rates are described in section IV. Discussion and comparison with earlier work is provided in section V.

0404 Oil Production, Recovery, And Refining

19700 **(SAND—83-1460) Prediction of rubble characteristics and flow fields through a porous medium using gaseous tracers: a feasibility experiment.** Romero, C.A., Uhl, J.E. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1984. Contract AC04-76DP00789. 198p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84009508.

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Results from an extensive series of tracer tests are presented. Nonradioactive tracer gases were injected into a large experimental retort at Laramie, Wyoming. The retort was filled with crushed and screened raw oil shale from the Anvil Points mine. The resulting data were used to study the feasibility of the use of gaseous tracers to characterize modified in situ (MIS) oil shale retorts. The effect of an impermeable cylindrical obstruction within the rubble on the resulting tracer signals was quantified. In addition to the tracer tests, thermal data were obtained from a steam front passed through the retort by the steady-flow addition of a 30 volume percent steam/air mixture. The resulting temperature profile was uniform, indicating a negligible effect of the zero-permeability region on steam sweep efficiency. The tracer signals, however, were slightly affected by the presence of the non-uniformity. In addition, wall effects and local regions of less pronounced non-uniformities were apparent from the tracer responses, but not from the thermal data. This experiment has demonstrated that tracers are effective in determining the existence of permeability contrasts. Further testing on a similar retort, but with a more significant discontinuity (one which would reduce the steam sweep efficiency) is recommended to verify the characterization ability of tracers. This report includes all the data in graphical form as well as a complete summary of the analysis. It constitutes a data base which could be used in future model development and verification of both forward and inverse solutions.

19701 **An engineering model for prediction of in situ oil shale retort blasting.** Quong, R. (In Situ Technologies Division, Sandia National Laboratories, Albuquerque, New Mexico 87185). *Oil Shale Symposium Proceedings;* 451-468(Apr 1983). (CONF-830434—).

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

The in situ extraction of oil from most oil shale beds is highly dependent upon explosive fracturing and rubbling of rock in a controlled and predictable manner. In blasting, it is necessary not only to fracture the rock, but also to move the broken rubble in a predictable manner. Most in situ extraction techniques require rubblization to take place in a confined region where rock motion is a predominate factor in creating a permeable broken bed. In this paper, an engineering model is presented which describes the large rubble motion during blasting. In this model the rock medium is represented by a discrete series of circular regions of fractured material. These regions are set in motion by pressure loads from the explosive. The motion of the regions is calculated using a step-wise, explicit, numerical time integration method. Interaction of adjacent regions is based on inelastic impact of spherical bodies. The derivation of this model is presented along with the background for selecting loading pressure based on explosive behavior.

19702 **Median residence and dispersion times for fluidization of crushed oil shale.** Christiansen, D.E.; Mallon, R.G. (Lawrence Livermore National Laboratory, Livermore, CA). *Oil Shale Symposium Proceedings;* 199-206(Apr 1983). (CONF-830434—).

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Median residence times and dispersions for crushed oil shale flowing downward through a fluidized bed were measured as a function of particle-size, nominal residence time, and fluidizing gas velocity. For fluidized beds containing narrow particle-size distribution, it was found that median residence time and dispersion increase with nominal residence time, decrease with increasing gas velocity, and show mixed results with change in particle-size. The results for fluidized beds of broad particle-size distribution were different. Increasing the nominal residence time increased the median residence time but had no regular effect upon dispersion. The gas velocity was observed to have a strong effect upon dispersion but little effect upon median residence time. When particle-size effects in this broad particle-size bed were investigated, it was found that the finer particles had a longer median residence time and were more widely dispersed than the coarser particles.

19703 **Material balance technique for analysis of in situ oil shale retorting.** Major, B.H.; Hommert, P.J. (Sandia National Laboratory, Albuquerque, NM). *Oil Shale Symposium Proceedings;* 228-241(Apr 1983). (CONF-830434—).

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Data essential for the evaluation of in situ oil shale retorts are the amount of shale retorted and the magnitude of various oil degradation mechanisms. These quantities, especially the former, can be difficult to estimate for field experiments. A material balance technique has been developed that can be used with product analysis to determine both shale retorted and oil loss to combustion. The technique relies on a combination of standard concepts of material balance and stoichiometry specific to oil shale retorting. Key parameters within the technique are estimated from laboratory data to allow the approach to be extended to field situations. Application of the technique to recent field results from Geokinetics and Occidental show that the yield from these tests appears to be greater than that previously reported. This is due, in all likelihood, to inadequate accounting of potential liquid product produced in the gas phase.

19704 **Results from the simultaneous processing of modified in situ retorts 7 & 8.** Stevens, A.L.; Zahradnik, R.L. (Occidental Oil Shale, Inc., Grand Junction, CO). *Oil Shale Symposium Proceedings;* 267-280(Apr 1983). (CONF-830434—). Contract FC20-79LC10036.

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Occidental Oil Shale, Inc., recently completed the demonstration of mining, rubblization, ignition, and simultaneous processing of two commercial-size modified in situ (MIS) retorts at its Logan Wash Facility near De Beque, Colorado. The retorts were constructed with an average rubble void of 18.5 percent in the low-grade shale (17 gallons per ton) at this site. Total product yield averaged 70 percent of the Fischer Assay oil-in-place in the target rubble in the two retorts.

19705 **Analysis of Occidental vertical modified in situ retorts 7 and 8.** Bickel, T.C. (Sandia National Laboratories, Albuquerque, New Mexico). *Oil Shale Symposium Proceedings;* 281-295(Apr 1983). (CONF-830434—).

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Sandia National Laboratories has recently participated with Occidental Oil Shale, Inc. in the processing of vertical modified in situ (VMIS) Retorts 7 and 8. These retorts were extensively instrumented, commercial-size retorts (50 m x 50 m x 75 m) that were processed concurrently at Occidental's Logan Wash site near Debeque, Colorado. Retorts 7 and 8 each contained 340,000 tonnes of rubble with rubble voids of 18.5%. Average shale grades were 72 l/ tonne (17.2 gpt) and 70 l/tonne (16.8 gpt) for Retorts 7 and 8, respectively. The extensive array of instrumentation (in situ thermocouples, flow measurement transducers, gas chromotography (GC) equipment and surface process instrumentation) allowed continuous monitoring of the retorts. Also, material balance calculations provided real time values of combustion losses, shale retorted and oil produced. Calculated local yields averaged 52% during the processing of both retorts. Retorts 7 and 8 were processed about 300 and about 330 days, respectively, providing an excellant data base for post-burn analyses. The sweep efficiencies (based upon thermal data) were 81% and 89% for Retorts 7 and 8, respectively. Thermal data also indicates extensive retorting occurred beyond the rubble boundary (about25% of initial rubble mass). Energy balances show an energy utililization of 0.33 kg shale retorted/mole O_2 injected for Retort 7 and 0.37 kg shale retorted/mole O_2 injected for Retort 8.

19706 **Improving flow uniformity in vertical modified in situ oil shale retorts.** Ricketts, T.E. (Cathedral Bluffs Shale Oil Co., Grand Junction, CO). *Oil Shale Symposium Proceedings;* 296-314(Apr 1983). (CONF-830434—).

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

In the past, vertical modified in situ (VMIS) retorts have been designed and constructed to produce rubble beds having uniform rubble properties which would thus give uniformity of flow within the beds. This uniform rubble bed approach strived to produce constant void fraction and particle size within all regions of the rubble bed after blasting. Thus, it was assumed that the retort edge effects due to blasting which may affect both particle size and void fraction around the chamber perimeter, would be eliminated using suitable blasting techniques. The retorts 7 and 8 blast results showed a definite improvement in rubble bed uniformity over retort 6, but edge effects in the form of higher permeability were still produced. The retorts 7 and 8 blasting design reduced the area of influence of the edge effects to a fairly narrow band around the perimeter of the retorts which resulted in a much larger, more uniform central region than was obtained in retort 6. Additionally, the values of the void fraction in the perimeter and central regions were closer to one another for retorts 7 and 8 than they were for retort 6. This type of rubble bed has resulted in an improved retorting performance compared to retort 6, but there is still significant incentive for improving rubble bed uniformity in order to further increase MIS oil yield values. The data necessary to design rubble beds that exhibit a uniform flow distribution now exists, much of it from full-scale retort results, using a newly developed uniform flow approach.

19707 **Sandia/Geokinetics retort 23: Comparison of real-time analyses with post-burn coring results.** Tyner, C.E.; Cook, D.W.; Costomiris, E.G. (Sandia National Laboratories, Albuquerque, New Mexico). *Oil Shale Symposium Proceedings;* 335-344(Apr 1983). (CONF-830434—).

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Retort 23, a 6000-tonne horizontal in situ oil shale retorting experiment conducted by Sandia National Laboratories and Geokinetics, Inc., was completed in June, 1981. Detailed analyses of retort performance based upon data available in real-time (flows, temperatures, product compositions) were made at that time. Seventeen months after completion of the experiment, the retort had cooled enough to allow recovery of spent shale samples from six vertical core wells at various locations in and just outside the

retort. All cores were logged and photographed; in addition, two complete cores (plus one pre-burn core) were analyzed chemically. We present comparisons of visual observations and chemical analyses of the cores with real-time results (thermal data and material balance calculations) to verify such indicators of retort performance as the extent of retorting, carbonate decomposition, and char combustion. While these data were, of course, important in completing the analyses of retort 23, they have had even more significance in validating realtime analyses techniques for use on other retorts.

19708 **Economics derived from detailed and definitive design of Superior's Circlar Grate Retort for an 18,000 BPD oil shale demonstration plant.** Lilley, D.F.; Fishback, J.W. (Oil Shale Div., Superior Oil Co., Englewood, CO). *Oil Shale Symposium Proceedings;* 365-372(Apr 1983). (CONF-830434—).

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Superior Oil Company has continued efforts to reduce to practice the Superior retorting technology as applied to oil shale. From February 1981 to October 1982, Superior has participated in a cost sharing agreement with the Department of Energy for detailed design of the Superior Circular Grate Retort, definitive design of retort ancillaries, auxiliaries and offsites, and mining, and for capital and operating cost estimates for a nominal 18,000 BPD oil shale plant. The terms, detailed design and definitive design, are defined. The design documents are described in sufficient detail to render an overview to the reader of the basis used for project cost estimates and economic analysis.

19709 **U.S. tar sand oil recovery projects.** Marchant, L.C.; Terry, R.E. (U.S. Department of Energy, Laramie Energy Technology Center, Laramie, Wyoming). pp 145-166 of Synthetic fuels from oil shale and tar sands. Chicago, IL; I.G.T. (1983).

The increasing U.S. energy demands, decreasing conventional crude oil reserves, and decontrol of crude oil prices have resulted in significant numbers of projects in U.S. tar sands. Data are reported for 62 projects involving in situ, mining and plant extraction, modified in situ and upgrading technologies. The data include operator name, project location, project status (completed, current, or planned), project type (commercial or pilot), reservoir and oil characteristics, and estimated product costs. The cost estimates per unit of produced oil provide encouragement for the commercialization of the U.S. tar sand resource.

19710 **Conversion of eastern shale with hydrogen-donor solvents.** Cronauer, D.C.; Danner, D.A.; Seshadri, K.S.; Solash, J. (Gulf Research and Development Co., Pittsburgh, PA). pp 407-424 of Synthetic fuel from oil shale and tar sands. Chicago, IL; I.G.T. (1983). Contract AC01-82FE60194.

Under DOE sponsorship, hydrogen-transfer experiments have been done with solvents of varying hydrogen-donor capacity to observe the extent of conversion of Fleming County, Kentucky shale (Cleveland member Ohio shale) to pentane and toluene solubles. Even at relatively mild conditions of 400°C and 30 min space time, extensive yields of pentane and toluene solubles have been achieved with tetralin as a solvent. At 450°C, conversion of the organics in this shale to toluene solubles approached 90% at an apparent optimum reaction time of 5 to 10 min. Conversions were much less when a poor-donor solvent, mesitylene, was used. Comparison experiments were also made with a western U.S. shale, and the effect of hydrogen transfer during solvation was much different with this shale. A cursory characterization of selected liquid products by combined gas chromatography/mass spectrometry is also discussed.

19711 **Battelle's Multi-Solids Fluidized Bed Oil Shale Retort.** Steedman, W.G.; Appelbaum, M.R.; Shirley, F.W. (Battelle Columbus Laboratories, Columbus, Ohio). pp 425-436 of Synthetic fuels from oil shale and tar sands. Chicago, IL; I.G.T. (1983).

Battelle is developing the Multi-Solids Fluidized Bed (MSFB) Oil Shale Retort under contract to the U.S. Department of Energy. This retort features an entrained bed of small particles (spent shale) superimposed on a permanently fluidized bed of large dense particles. The heat required for retorting is supplied by burning retorted shale in a separate fluidized bed and is delivered to the retort by the recirculating entrained bed. This paper describes the development effort and discusses the major experimental results of the on-going effort.

19712 **Producing jet fuel from oil shale.** Lekas, J.M.; Zaslove, W. (Geokinetics, Inc., Salt Lake City, Utah). pp 489-495 of Synthetic fuels from oil shale and tar sands. Chicago, IL; I.G.T. (1983).

Geokinetics, in Cooperation with the U.S. Department of Energy is developing our in situ process for producing crude shale oil. R & D has been underway for eight years at a cost of $15 million. Development work will be completed in 1983, and plans are to construct a 1,000 barrel/day commercial plant to be operational in early 1985. Geokinetics has entered into a contract with the Department of Defense to refine 82,000 barrels of crude shale oil into products meeting military specifications, primarily jet fuel. The refining will be done at the Caribou Four Corners refinery at Salt Lake City.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 19630

19713 **Characterization of organic material in Chattanooga oil shale and shale oil.** McGowan, C.; Kerr, C.P.; Leimer, H.W. (Department of Chemistry, Tennessee Technological University, Cookeville, Tennessee). pp 229-246 of Synthetic fuels from oil shale and tar sands. Chicago, IL; I.G.T. (1983).

It has been proposed that the Chattanooga Oil Shale in Tennessee be considered as an alternative energy source. In order to evaluate this resource, five cores from a sevencounty Eastern Highland Rim area were analyzed for shale thickness, organic components, mineralogy, major inorganic elements, trace inorganic elements and modified Fischer Assay. Analyses indicated that in the initial study area the SW Putnam-NW White County area was the best potential mine-plant site. Six additional cores were taken in this area and analyzed as before. One square mile of Chattanooga Shale in the restricted study area contains 14.4 million barrels of oil using normal retorting methods. Benzene soluble bitumen was extracted from each core. The bitumen was analyzed by ultraviolet and infrared spectroscopy. Elemental analysis for C, H, N, O, and S were also performed. The bitumen and a Fischer Assay oil were separated into acid, base and neutral fractions. Each fraction was analyzed in similar fashion as the bitumen. The relative size of the acid fraction of the oil was less than the acid fraction of the bitumen. The neufral fraction of the oil was larger than the neutral fraction of the bitumen. Analysis indicated the presence of both aliphatic and aromatic structures. Carboxylic acids present in the bitumen were not found in the oil. The presence of highly carcinogenic primary aromatic amines were also indicated in the base fraction of both the bitumen and the oil.

19714 **Reduction of Eastern U.S. oil shale kerogen using dissolving metals.** Solash, J.; Cronauer, D.C. (Gulf Research and Development Co., Pittsburgh, PA). pp 267-278 of Synthetic fuels from oil shale and tar sands. Chicago, IL; I.G.T. (1983). Contract AC01-82FE60194.

The chemical nature of eastern oil shale kerogen was explored. A kerogen concentrate of Cleveland member, Fleming # 2, Kentucky shale was prepared by acid extracting the shale with HCl and HF. Bitumen was removed by Soxhlet extraction using benzene:methanol. Bulk minerology of the "as received" and kerogen concentrate was performed. The kerogen concentrate was reductively alkylated using sodium in hexamethylphosphoric triamide (HMPA). Alkylation was accomplished by quenching the anionic intermediates using protons (via CH_3OH) or ethyl, isopropyl, and butyl groups. The results of reductive alkylation of eastern oil shale kerogen indicate that this material is more like coal than like Green River oil shale kerogen. About 12% of the eastern oil shale kerogen was converted to toluene solubles using $FeCl_3/Ac_2O$. NMR analysis reveals this extract to be primarily aliphatic.

0408 Marketing And Economics

REFER ALSO TO CITATION(S) 19708

0409 Waste Research And Management

19715 **(DOE/LC/10678—1563) Physical-chemical treatment of tar sand processing wastewater: Task No. 3. Dewatering of foamate residuals; Task No. 4. Leaching potential of sludges; and Task No. 5. Summary of economic considerations. Final report.** King, P.H. (Arizona Univ., Tucson (USA). Dept. of Civil Engineering and Engineering Mechanics). Nov 1983. Contract AS20-81LC10678. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84003088.

The dewatering properties of residuals generated by flotation/foam fractionation treatment of TS-1S wastewater were evaluated. The leachate potential was studied for both chemical coagulation and flotation/foam fractionation sludges. A preliminary economic analysis was made comparing selected sludge disposal options and summarizing previously reported economic analysis of the chemical treatment alternatives.

19716 **(DOE/LC/10686—T1) Adsorption of organics from tar sand water by activated carbon in packed beds. Final report.** Hines, A.L.; Pedram, E.O. (Wyoming Univ., Laramie (USA). Dept. of Chemical Engineering). 30 Dec 1982. Contract AS20-81LC10686. 54p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84006468.

The adsorption of TS-1S and TS-2C tar sand waters were studied at 278 and 298°K on activated carbon in both batch and packed bed experiments. The isotherms were nonlinear over the entire liquid concentration ranges. Breakthrough curves were obtained in packed bed experiments as a function of bed lengths, particle size, and liquid velocity. A mechanistic approach was used to solve the mass transfer equations for the packed adsorber, the mass transfer coefficients and the rates of adsorption were calculated. Also the breakthrough curves were analyzed to establish the relative importance of the various individual mechanisms that contributed to the overall adsorption process.

19717 **Attrition of spent oil shales during pneumatic conveying and cyclone separating.** Carley, J.F. (Lawrence Livermore National Laboratory, Livermore, CA). *Oil Shale Symposium Proceedings;* 207-227(Apr 1983). (CONF-830434—). Contract W-7405-ENG-48.

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Retorted and burnt shales prepared from rich and lean raw shales were blown through a 6-m vertical lift pipe and a small cyclone separator at gas velocities of 15 and 30 m/s, passing through the system either once or ten times. Size distributions of feeds and cyclone-bottom products were measured, as were those of some of the cyclone-top dusts. Aspect ratios of particles from the feedstocks and selected products were measured with the Quantimet 720. The size distributions of all the materials were downshifted during gasveying and cycloning, the lean, retorted shale only slightly, the rich, burnt material most severely. The new exterior surface area generated through attrition, estimated from the drag-mean particle size, rose as the square of the gas velocity and the 0.7 power of the number of passes. The aspect-ratio studies showed that the attritted particles were more rounded than the feeds and became more so with increasing gas velocity and repeated passes. This evidence, and the character of the size-distribution shifts, shows that the main mechanism of attrition of these materials is the breaking away and abrasion of asperities. Particle loading had no effect at all upon any of the size-distribution paramters or new-surface generation. This finding implies that attrition occurred by contact between particles and equipment walls rather than by interparticle collisions. It should therefore be less severe in larger equipment.

19718 **Biotreatment of oil shale wastewaters.** Mealy, J.B.; Daughton, C.G.; Jones, B.M.; Langlois, G.W. (Energy and Environmental Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California). *Oil Shale Symposium Proceedings;* 498-511(Apr 1983). (CONF-830434—). Contract AC03-76SF00098.

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Aerobic bacterial oxidation was evaluated for nine wastewaters from surface, modified in-situ, true in-situ, and simulated in-situ retorting processes: Oxy-6 gas condensate, Rio Blanco sour water, and Oxy-6, 150-Ton, TOSCO HSP, S-55, Omega-9, Geokinetics-9, and Paraho retort waters. Extensive acclimations for competent microbiota were completed after several months of serial enrichments using each water as a sole source of carbon, nitrogen, and energy. Each water was diluted prior to biotreatment with an equal volume of inorganic orthophosphate buffer that contained essential trace elements. Preliminary experiments have indicated that losses of dissolved organic carbon (DOC) via volatilization could be extensive (e.g., up to one third); such losses could easily be mistaken for biologically mediated removal. Biodegradation was therefore assessed in screw-capped shake-flasks that contained sufficient headspace to ensure aerobic conditions. Biological removals of DOC ranged from 9% for Oxy-6 gas condensate to 49% for Oxy-6 retort water. Sample fractionation by a reverse-phase separation method indicated that the majority of the mineralized DOC resided in the hydrophilic fraction (HpF); this supported the hypothesis that compounds in this polar fraction were more easily biodegraded than those in the lipophilic fraction (LpF). Total removal of DOC from any water did not exceed the amount of carbon in the HpF.

0410 Enviromental Aspects

19719 **(USGS-OFR—82-1051) Effects of processed oil shale on the element content of Atriplex cancescens.** Anderson, B.M. (Geological Survey, Denver, CO (USA)). 1982. 18p. USGS-Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Samples of four-wing saltbush were collected from the Colorado State University Intensive Oil Shale Revegetation Study Site test plots in the Piceance basin, Colorado. The test plots were constructed to evaluate the effects of processed oil shale geochemistry on plant growth using various thicknesses of soil cover over the processed shale and/or over a gravel barrier between the shale and soil. Generally, the thicker the soil cover, the less the influence of the shale geochemistry on the element concentrations in the plants. Concentrations of 20 elements were larger in the ash of four-wing saltbush growing on the plot with the gravel barrier (between the soil and processed shale) when compared to the sample from the control plot. A greater water content in the soil in this plot has been reported, and the interaction between the increased, percolating water and shale may have increased the availability of these elements for plant uptake. Concentrations of boron, copper, fluorine, lithium, molybdenum, selenium, silicon, and zinc were larger in the samples grown over processed shale, compared to those from the control plot, and concentrations for barium, calcium, lanthanum, niobium, phosphorus, and strontium were smaller. Concentrations for arsenic, boron, fluorine, molybdenum, and selenium - considered to be potential toxic contaminants - were similar to results reported in the literature for vegetation from the test plots. The copper-to-molybdenum ratios in three of the four samples of four-wing saltbush growing over the processed shale were below the ratio of 2:1, which is judged detrimental to ruminants, particularly cattle. Boron concentrations averaged 140 ppM, well above the phytotoxicity level for most plant species. Arsenic, fluorine, and selenium concentrations were below toxic levels, and thus should not present any problem for revegetation or forage use at this time.

19720 **Evaluation of control technology for modified in situ oil shale retorts.** Persoff, P.; Fox, J.P. (Energy and Environment Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Oil Shale Symposium Proceedings;* 534-540(Apr 1983). (CONF-830434—). Contract AC03-76SF00098.

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

Experiments were conducted to evaluate two technologies to control groundwater pollution due to leaching of abandoned modified in-situ (MIS) retorts, retort grouting and intentional leaching. Retort grouting to reduce permeability was evaluated by measuring the permeability of grouts containing only raw or refined

waste materials (Lurgi spent shale, fly ash, gypsum tailings, and lignosulfonate fluidizers). The principal factor controlling grout formulation was the requirement for adequate fluidity without bleeding. This was achieved by inclusion of 0.25% lignosulfonate fluidizer in the grout. Permeability of the cured grouts decreased with increasing confining pressure; at 200 psi confining pressure, permeabilities as low as $5x10^{-7}$ cm/sec were measured. Electrical conductivity measurements on the permeate produced during permeability measurements suggest that grouting abandoned MIS retorts would increase the TDS of leachate by a factor of approximately 3; benefit of the proposed grouting operation would depend upon the flow rate through retorts being reduced by a greater factor to reduce the total mass (concentration × flow) of solute released. Comparison of the measured grout permeabilities to the permeability of surrounding rock suggest that this would be the case.

19721 **Oil shale health and environmental risk analysis.** Gratt, L.B. (IWG Corp., San Diego, CA). *Oil Shale Symposium Proceedings;* 541-549(Apr 1983). (CONF-830434—). Contract AC02-82ER60087.

From 16. oil shale symposium; Golden, CO, USA (13 Apr 1983).

The potential human health and environmental risks of hypothetical one-million-barrels-per-day oil shale industry have been analyzed to serve as an aid in the formulation and management of a program of environmental research. The largest uncertainties for expected fatalities are in the public sector from air pollutants although the occupational sector is estimated to have 60% more expected fatalities than the public sector. Occupational safety and illness have been analyzed for the oil shale fuel cycle from extraction to delivery of products for end use. Pneumoconiosis from the dust environment is the worker disease resulting in the greatest number of fatalities, followed by chronic bronchitis, internal cancer, and skin cancers, respectively. Research recommendations are presented for reducing the uncertainties in the risks analyzed and to fill data gaps to estimate other risks.

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 20431

0501 Reserves

19722 **(USGS-OFR—78-1008) Principal uranium deposits of the world.** Byers, V.P. (Geological Survey, Denver, CO (USA)). 1978. 396p. NTIS, PC A17. Order Number DE83902372.

Paper copy only, copy does not permit microfiche production.

The geology of the principal world uranium deposits that have identified uranium reserves and production is summarized including type of deposit, host rock and age of host rock, age of mineralization, depositional environment, and mineralogy. The deposits grouped on maps according to age of host rocks - Precambrian, Paleozoic, Mesozoic, and Cenozoic - and further subdivided into types of deposits and size categories. Types of deposits are peneconcordant sandstone, quartz-pebble conglomerate, vein and vein-type, marine black shale, phosphate deposits, coaly carbonaceous rocks, and pegmatic and alaskitic rocks. The economically most significant deposits of uranium known in 1975 are in quartz-pebble conglomerates and sandstones, which together represented about 75% of the world's total production. The largest deposits occur in quartz-pebble conglomerate at the Elliot Lake-Blind River area, Canada (average grade 0.12 % U_3O_8), and at the Witwatersrand basin area in the Republic of South Africa (average grade 0.025 % U_3O_8), where uranium is produced principally as a byproduct or coproduct of gold mining; and in medium-grained sandstones in the Colorado Plateau, USA (average grade 0.2 % U_3O_8). Other economically significant concentrations are vein, pegmatite or contact metamorphic types, containing smaller but relatively high-grade tonnages and representing about 20 % of the world's total production. As Vaestergotland and Naerke in Sweden, uranium has been recovered on a pilot-plant basis from black shale deposits having an uncommonly high grade for black shale of 0.03 % U_3O_8. Recoverable reserves in the (40 year period, lifetime of nuclear plants) is on the order of 50,000 metric tons U. Over 50 % of the world's total uranium reserves is located on or near the trend of the iron deposits in the Precambrian iron formation, referred to as the iron band.

19723 **(USGS-OFR—79-1178) Limitations on genesis of uranium ores, Midnite Mine, Washington, based on lead-uranium ages.** Nash, J.T.; Ludwig, K.R. (Geological Survey, Denver, CO (USA)). 1979. 8p. USGS Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

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New information is reported on the following: age of pluton, lead isotope systematics, age of ores, age of Sanpoil volcanics, post-intrusion alteration, geology in the Eocene, paragenesis, and source of uranium. 5 references, 2 figures.

0503 Mining

REFER ALSO TO CITATION(S) 19820, 20753

0504 Feed Processing

19724 **Predicted deposition rates of uranium yellowcake aerosols sampled in uranium mills.** Eidson, A.F., Damon, E.G. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *Health Physics;* **46**: No. 1, 165-176(Jan 1984). Contract AC04-76EV01013.

Uranium aerosols generated during normal yellowcake packaging operations were sampled at four uranium mills. Samplers located in the packaging area were operated before, during and after drums of yellowcake were filled and sealed. Median aerosol concentrations in the packaging areas ranged from 0.04 μg U/1 to 0.34 μg U/1. The aerosols were heterogeneous and included a broad range of particle sizes such that 14% to 76% (by weight) of the airborne uranium was in particles with aerodynamic diameters greater than 12 μm. Air concentrations and particle-size distributions varied with time as larger particles settled or more aerosols were suspended. Aerosol characteristics could often be related to individual packaging steps. The results show that appreciable amounts of airborne uranium would be expected to deposit in the nasopharyngeal compartment of the respiratory tract inhaled by a worker not wearing respiratory protection.

0505 Enrichment

REFER ALSO TO CITATION(S) 19834, 19836, 19837, 19838, 19839

19725 **Effect of vacuum core boundary conditions on separation in the gas centrifuge.** Halle, E.; Lowry, R.A.; Wood, H.G. (Oak Ridge Gaseous Diffusion Plant, Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee 37830). *Nuclear Technology;* **62**: No. 3, 325-334(Sep 1983). Contract AC05-82OR20900;W-7405-ENG-26.

A vacuum exists in the central region of the cylindrical rotor of a high-speed countercurrent gas centrifuge when operated with UF_6 for the enrichment of uranium. Since solutions of the Navier-Stokes equation are used to determine the isotopic distribution in the rotor, the location of the vacuum core boundary has a direct effect on the predicted separative work of the gas centrifuge. Because criteria for terminating the continuum region based on the Knudsen number are somewhat arbitrary, an approximate model developed by Onsager, which yields an analytical solution, has been used to evaluate the location of the boundary of the vacuum core more correctly. The results show that the location of this "top of the atmosphere," in density scale heights, changes with the peripheral speed of the centrifuge. Using this location in the calculation of separation performance parameters of the gas centrifuge reduces, at the higher peripheral speeds, the contribution of axial diffusion to the effective stage length of a theoretical stage in the centrifuge. The correction due to imposing the top of the atmosphere limitation on axial diffusion becomes significant at high speeds and low countercurrent circulation rates.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 19830

19726 **(FEI—1249) Theoretical model for development of gas porosity in nuclear reactor materials. Oxide fuel.** Chkuaseli, V.F.; Mikhlin, Eh.Ya. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700746.

A qualitative model for gas release and swelling based on representations that gas porosity progress is caused with collisions and coalescences of moving pores has been developed. When describing pore movement in the process of random roaming or under the temperature gradient, the suppression of small size pore mobility were considered. The model developed was proved on oxide fuel. The calculations perfo·.ned have shown that the model permits to sufficiently well describe a large number of experimental data both on swelling and gas release and on the distribution of intragrain porosity as well as to reveal these phenomena dependence on different physical characteristics of material and its operating conditions.

19727 **(HEDL-SA—2892-FP) Development of DIPRES feed for the fabrication of mixed-oxide fuels for fast breeder reactors.** Griffin, C.W.; Rasmussen, D.E.; Lloyd, M.H. (Pacific Northwest Lab., Richland, WA (USA); Hanford Engineering Development Lab., Richland, WA (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract AC06-70FF02170. 24p. (PNL-SA—10970; CONF-830451—29). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84003952.

From American Ceramic Society annual meeting; Chicago, IL, USA (25 Apr 1983).

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The DIrect PREss Spheroidized feed process combines the conversion of uranium-plutonium solutions into spheres by internal gelation with conventional pellet fabrication techniques. In this manner, gel spheres could replace conventional powders as the feed material for pellet fabrication of nuclear fuels. Objective of the DIPRES feed program is to develop and qualify a process to produce mixed-oxide fuel pellets from gel spheres for fast breeder reactors. This process development includes both conversion and fabrication activities.

19728 **Tracer surface diffusion on UO_2.** Zhou, S.Y.; Olander, D.R. (Institute of Atomic Energy, Box 275(58), Beijing). *Transactions of the American Nuclear Society;* **45**: 281-282(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 19835

19729 **(AERE-R—6463) Solubility of uranium dioxide in fluoride melts.** Greenfield, B.F.; Hyde, K.R. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Feb 1983. 20p. HMSO, London, price $2.00.

The solubility of UO_2 in UF_4 and in a range of binary mixtures of diluent fluorides with UF_4 has been determined. The smaller the cation of the diluent fluoride and the greater its charge the less it depresses the solubility of UO_2 in UF_4. The equilibrium solubility and the rate of solubility of UO_2 have also been determined in a number of ternary melts containing UF_4. This work was in support of a process for the electrowinning of uranium metal from UO_2 by the operation of an electrolytic cell at ca. 1250 deg C, using a fluoride melt.

19730 **(DOE/NBM—4007543) Statement on the Consolidated Fuel Reprocessing Program.** Trauger, D.B. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007543.

Oak Ridge National Laboratory has chosen the following objectives for future reprocessing plant design: reduced radiation exposure to workers; minimal environmental impact; improved plant operation and maintenance; improved accountability; no plutonium diversion; and reduced overall capital and operating cost. These objectives lead to a plant with totally remote operation. The Breeder Reactor Engineering Test (BRET) has been designed to perform a key role in demonstrating advanced reprocessing technology. It has been scheduled to be available to reprocess spent fuel from the Fast Flux Test Facility. The principal features of the Consolidated Fuel Reprocessing Program and of the BRET facility are appropriate for all reactor types.

19731 (PNCT—831-80-01, pp 177-186) **Experience in the replacement of the failed acid-recovery evaporator at the Tokai Reprocessing Plant.** Hayashi, Shotaro; Yamamura, Osamu; Araya, Sadao (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1980. NTIS (US Sales Only), PC A09/MF A01.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Jan 1979 - Mar 1980.

Through the replacement of the failed acid-recovery evaporator for about eight months, valuable know-hows in connection with maintenance in a hot cell were obtained. A new evaporator was made of stainless steel (25Cr-20Ni-0.25Nb), and was fabricated in Japan. Many mock-up tests for welding were performed and evaluated before actual manufacture, and the best welding procedure was selected based on the results of such mock up tests. The welding works of the evaporator and connected pipes in the cell were carried out successfully in spite of operational space limitations. Also the personal exposure had been well controlled and the contamination on human body and out-cell area had been prevented completely.

19732 (PNCT—831-80-01, pp 171-176) **Activity of the reprocessing plant (Jan. 1979 - Mar. 1980).** Sep 1980. NTIS (US Sales Only), PC A09/MF A01.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Jan 1979 - Mar 1980.

The Hot Test from JPDR to GTP campaign was finished on February 24, 1980. During these campaigns, the plant was obliged to stop the operation in August, 1978, because of the failure of the acid recovery evaporator. However, the installation of a new evaporator was performed very successfully without any significant trouble, and the operation was resumed in October, 1979. In order to confirm the capacity of the new evaporator and the skill of operators after one year of operation stoppage, pre-guarantee test (called PGT) was carried out in November, 1979, using 5.1 tons of spent fuel. After this step, the final stage of the Hot Test, namely guarantee test (called GTP), was started in January, 1980, using 6.8 tons of the spent fuel from the Mihama PWR. The GTP campaign was executed very smoothly, and it was confirmed that the plant can be operated safely and successfully. In the Hot Test, from 31 tons of spent fuel, about 28 tons of uranium and 168 kg of plutonium were recovered, and the purity of plutonium and uranium products was as specified. The workability, safety and processing capacity were verified as satisfactory. The plutonium product was used partially for the production of mixed oxide fuel for the ATR "Fugen". About 44 tons of spent fuel were transported to the plant for post-hot test operation.

19733 (UTNL-R—0110, pp 45-49) **Trends in fuel reprocessing safety research.** Tsujino, Takeshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01.

In Summaries of environmental safety in nuclear fuel cycles; fiscal 1979 and 1980.

With the operation of a fuel reprocessing plant in the Power Reactor and Nuclear Fuel Development Corporation (PNC) and the plan for a second fuel reprocessing plant, the research on fuel reprocessing safety, along with the reprocessing technology itself, has become increasingly important. As compared with the case of LWR power plants, the safety research in this field still lags behind. In the safety of fuel reprocessing, there are the aspects of keeping radiation exposure as low as possible in both personnel and local people, the high reliability of the plant operation and the securing of public safety in accidents. Safety research is then required to establish the safety standards and to raise the rate of plant operation associated with safety. The following matters are described: basic ideas for the safety design, safety features in fuel reprocessing, safety guideline and standards, and safety research for fuel reprocessing.

19734 (UTNL-R—0110, pp 50-54) **Present status of fuel reprocessing plant in PNC.** Koyama, Kenji (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01.

In Summaries of environmental safety in nuclear fuel cycles; fiscal 1979 and 1980.

In the fuel reprocessing plant of the Power Reactor and Nuclear Fuel Development Corporation, its hot test has now been completed. For starting its full-scale operation duly, the data are being collected on the operation performance and safety. The construction was started in June, 1971, and completed in October, 1974. In July, 1977, spent fuel was accepted in the plant, and the hot test was started. In September, the same year, the first fuel shearing was made. So far, a total of about 31 t U from both BWR and PWR plants has been processed, thus the hot test was entirely completed. The following matters are described: hot test and its results, research on Pu and U mixed extraction, utilization of product plutonium, development of safeguard technology, and repair work on the acid recovery evaporation tank.

19735 **Arrangements for the detection of criticality incidents at BNFL Sellafield.** Evans, M.C.; Jones, T.H.; Watson, A.N. (British Nuclear Fuels Ltd., Windscale Nuclear Laboratories, Sellafield, Cumbria CA20 1PG). *Transactions of the American Nuclear Society;* **45**: 345-346(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

0509 Transport And Storage

REFER ALSO TO CITATION(S) 20586, 20593

19736 **(EPRI-NP—3365) Review of proposed dry-storage concepts using probabilistic risk assessment. Final report.** Orvis, D.D. (NUS Corp., San Diego, CA (USA)). Feb 1984. 248p. Research Report Center, Box 50490, Palo Alto, CA 94303.

The methods of probabilistic risk assessment (PRA) are applied to assess the relative public risk associated with four alternative storage concepts for spent reactor fuel. These alternatives include a reference pool storage facility and three dry storage schemes: cask, caisson (dry-well), and vault. These concepts are under consideration as means to increase the on-site storage capacity of reactor power plants as an alternative to off-site shipment to a storage or reprocessing facility. The analysis compares frequency versus consequence envelopes based on a wide spectrum of accident scenarios from handling and transport accidents to external events such as earthquakes. The principal observation is that none of the dry-storage concepts appears to exhibit any significant advantage over the other with respect to maximum risk. However, the pool concept appears to pose somewhat greater risk than any of the dry-storage concepts. The accident analyses indicate that handling and on-site transport operations yield the highest risk and that the risk is comparable for all concepts. 58 references, 41 figures, 66 tables.

0520 Waste Management

REFER ALSO TO CITATION(S) 19811, 19812, 19813, 19814, 19815, 19816, 19817, 19821, 19826, 20068, 20069, 20070, 20071, 20143, 20231, 21150, 21151, 21154, 21157

19737 **(AECL—7797) Dynamic response of underground openings in discontinuous rock.** Asmis, H.W. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Feb 1984. 73p. AECL Whiteshell Nuclear Research Est., Pinawa, Manitoba, Canada.

This report examines the behavior of underground openings in discontinuous rock in response to seismic waves associated with either earthquakes or rock bursts. A literature search revealed that well-constructed underground structures, such as would be expected for nuclear fuel waste disposal vaults, underground pumped-storage or nuclear plants, have an extremely high resistance to damage from seismic motion. To complement these qualitative results, it was necessary to examine the basic mechanisms of the entire progression of seismic motion, from wave generation and propagation, to wave interaction with the underground opening. From these investigations, it was found that unless a seismic event occurs very close to the installation, the stresses generated will be low with respect to the excavation stresses, because high stress waves are rapidly attenuated in travelling through rock. As well, an earthquake may generate extremely high accelerations, but is limited in the maximum amount of stress that it can create. The question, however, of the actual specific nature of underground seismic motions still remains essentially unanswered, although it is expected that there is a reduction in peak motions with depth due to the effect of the free surface of the earth. Since the underground opening is in a stressed regime, dynamic rupturing along an existing stressed joint or other discontinuity may prove to be a failure mechanism of concern. Such an event could be triggered by seismic motions or could occur spontaneously. Finite-difference computer simulations of seismic waves striking a cavern indicated that it would be difficult for seismic stresses to trigger slip-failure mechanisms. Discontinuities were allowed to rupture spontaneously in the model and it was found that the adhesion parameters of critical displacement and minimum angle of friction have a significant influence on stability. 31 references, 37 figures.

19738 **(ARH-SA—49) Laboratory evaluation of zeolitic material for removing radioactive cesium from alkaline waste solutions.** Buckingham, J.S. (Atlantic Richfield Hanford Co., Richland, WA (USA). Separations Chemistry Lab.). Jan 1970. Contract AC06-80RL01030. 19p. (CONF-700995—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009048.

From 2. international conference on zeolites; Worchester, MA, USA (7 Sep 1970).

An ion exchange process employing zeolitic material as the ion exchanger is used to remove radioactive cesium from the alkaline salt wastes generated by processing nuclear reactor fuels at Atlantic Richfield Hanford Company's chemical separations plants. The effect of pH on capacity and strength of zeolites is presented. The effect of temperature on loading and eluting characteristics is also shown. Experiences operating the plant ion exchange facility are discussed. 8 references, 6 figures, 4 tables.

19739 **(BMI/ONWI—523) Characterization of cement-based ancient building materials in support of repository seal materials studies.** Roy, D.M.; Langton, C.A. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). Dec 1983. Contract AC06-65RL01830;AC02-83CH10140. 147p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84010105.

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Ancient mortars and plasters collected from Greek and Cypriot structures dating to about 5500 BC have been investigated because of their remarkable durability. The characteristics and performance of these and other ancient cementitious materials have been considered in the light of providing information on longevity of concrete materials for sealing nuclear waste geological repositor-

ies. The matrices of these composite materials have been characterized and classified into four categories: (1) gypsum cements; (2) hydraulic hydrated lime and hydrated-lime cements; (3) hydraulic aluminous and ferruginous hydrated-lime cements (+- siliceous components); and (4) pozzolana/hydrated-lime cements. Most of the materials investigated, including linings of ore-washing basins and cisterns used to hold water, are in categories (2) and (3). The aggregates used included carbonates, sandstones, shales, schists, volcanic and pyroclastic rocks, and ore minerals, many of which represent host rock types of stratigraphic components of a salt repository. Numerous methods were used to characterize the materials chemically, mineralogically, and microstructurally and to elucidate aspects of both the technology that produced them and their response to the environmental exposure throughout their centuries of existence. Their remarkable properties are the result of a combination of chemical (mineralogical) and microstructural factors. Durability was found to be affected by matrix mineralogy, particle size and porosity, and aggregate type, grading, and proportioning, as well as method of placement and exposure conditions. Similar factors govern the potential for durability of modern portland cement-containing materials, which are candidates for repository sealing. 29 references, 29 figures, 6 tables.

19740 (CONF-840307—20) **Characterization of crystalline rocks in the Lake Superior region, USA: implications for nuclear waste isolation.** Sood, M.K.; Flower, M.F.J.; Edgar, D.E. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009160.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Portions are illegible in microfiche products.

The Lake Superior region (Wisconsin, the Upper Peninsula of Michigan, and Minnesota) contains 41 Precambrian crystalline rock complexes comprising 64 individual but related rock bodies with known surface exposures. Each complex has a map area greater than 78 km^2. About 54% of the rock complexes have areas of up to 500 km^2, 15% fall between 500 km^2 and 1000 km^2, 19% lie between 1000 km^2 and 2500 km^2, and 12% are over 2500 km^2. Crystalline rocks of the region vary widely in composition, but they are predominantly granitic. Repeated thermo-tectonic events have produced early Archean gneisses, migmatites, and amphibolites with highly tectonized fabrics that impart a heterogeneous and anisotropic character to the rocks. Late Archean rocks are usually but not invariably gneissose and migmatitic. Proterozoic rocks of the region include synorogenic (foliated) granitic rocks, anorogenic (non-foliated) granites, and the layered gabbro-anorthosite-troctolite intrusives of the rift-related Keweenawan igneous activity. Compared with the Archean rocks of the region, the Proterozoic bodies generally lack highly tectonized fabrics and have more definable contacts where visible. Anorogenic intrusions are relatively homogeneous and isotropic. On the basis of observed geologic characteristics, postorogenic and anorogenic crystalline rock bodies located away from recognized tectonic systems have attributes that make them relatively more desirable as a possible site for a nuclear waste repository in the region. This study was conducted at Argonne National Laboratory under the sponsorship of the US Department of Energy through the Office of Crystalline Repository Development at Battelle Memorial Institute, Columbus, Ohio. 84 references, 4 figures, 3 tables.

19741 (CONF-840512—7) **Environmental surveillance for low-level waste disposal sites.** Sedlet, J. (Argonne National Lab., IL (USA)). 1984. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE84003637.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

All nuclear facilities, including waste disposal sites, are expected to evaluate their effect on the environment. This paper describes a multidisciplinary approach to the design of environmental surveillance programs for near-surface disposal sites. Surveillance is broadly considered to include burial trench and other on-site measurements as well as offsite monitoring, and to include both radiological and non-radiological measurements. The objectives of a surveillance program are: to determine the extent of any pollutant migration early enough for corrective action to be taken to minimize adverse impacts, to provide data to assess the impact of site operations on the environment and public, to predict long-term waste behavior, to satisfy regulatory agency requirements, and to obtain data on site and pollutant behavior for the design of future disposal sites and surveillance programs. It should be recognized that shallow-land burial techniques will not retain the waste completely in place over time. Some migration is expected, but it must be acceptable in amount and rate. Surveillance programs will provide the information to determine if this is the case. Proper application of monitoring techniques and principles will result in a program that will meet its objectives and supply the data needed by operators and regulators to maintain a properly operating site. 1 reference.

19742 (CONF-8308106—) **Proceedings of the Fifth Annual Participants' Information Meeting: DOE Low-Level Waste Management Program.** (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1983. Contract AC07-76ID01570. 799p. NTIS, PC A99/MF A01; GPO Dep. Order Number DE84004134.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The meeting consisted of the following six sessions: (1) plenary session I; (2) disposal technology; (3) characteristics and treatment of low-level waste; (4) environmental aspects and performance prediction; (5) overall summary sessions; and (6) plenary session II. Fifty two papers of the papers presented were processed for inclusion in the Energy Data Base. (ATT)

19743 (CONF-8308106—, pp 9-15) **Fifth Annual DOE LLWMP Participants' Information Meeting welcome and introduction.** Large, D.E. (Dept. of Energy, Oak Ridge, TN). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

This meeting is designed to bring Department of Energy and contractor participants together, along with potential users of the Department of Energy Low-Level Waste Management Program's products and services, to exchange pertinent technical information and explore ways of achieving implementation of improved management of low-level radioactive waste. Speakers in the initial session will discuss their respective organizations' roles in low-level radioactive waste management, while speakers in the later sessions will present the technical meat of the program, to meet the purpose of the meeting which in brief is technology transfer. All attendees are encouraged to become involved in and to contribute to the workshops and open discussions. We will deal with achievements to date and indicate efforts necessary to assure appropriate management of both Commercial and Defense low-level nuclear wastes.

19744 (CONF-8308106—, pp 16-23) **Commercial low level radioactive waste program trends.** Jordan, E.A. (Dept. of Energy, Washington, DC). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The nuclear-energy funded low-level waste (LLW) management program in FY 1984 has as its primary goal continuing technical and financial assistance to the States in their implementation of the provisions of the Low Level Radioactive Waste Policy Act of 1980. This assistance has been provided for such areas as development of regional LLW management plans, compact formations, technology demonstrations, and disposal site screening and selection activities. In addition, the program supports technology development and demonstrations in waste volume reduction, waste migration, and disposal site stabilization and closure. Over the past three years the Program has supported state efforts. This has led to compacts being negotiated in all six regions, and four of the six compacts are expected to Congress this Fall.

19745 (CONF-8308106—, pp 24-30) **Emphasis and direction of NRC's low-level waste management program.** Conti, E.; Dunkelman, M.; Higginbotham, L.; Lohaus, P. (Nuclear Regulatory Commission, Washington, DC). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The projects sponsored by NRC's low-level waste management program are oriented toward licensing of new sites and implementing 10 CFR Part 61 licensing requirements for land disposal of radioactive wastes. The requirements for establishment of new sites, such as siting, design, and operations, were effective January 26, 1983. The requirements for waste form and classification will take effect on December 27, 1983. Technical assistance projects are directed primarily toward establishing guidance to implement the requirements; that is, to aid understanding and compliance by licensees and to support our licensing decisions. The Research projects have been mainly directed toward understanding and resolving problems at existing facilities. Continuing and future research will be directed toward developing methods which can be used in evaluating expected performance at new low-level waste disposal facilities as they are likely to be sited, designed, and operated.

19746 (CONF-8308106—, pp 31-51) **Overview of EPA's low-level radioactive waste standards development program, 1983.** Meyer, G.L.; Galpin, F.L.; Leiter, A.J. (Environmental Protection Agency, Washington, DC). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The US Environmental Protection Agency is developing generally applicable environmental standards for the land disposal of low-level radioactive wastes (LLW). An important part of this effort will be to determine whether some LLW contain sufficiently low levels of radioactivity to be below regulatory concern regarding their radioactive hazard. This paper describes the administrative processes involved in developing the LLW Standards and the technical studies that will be used to support them. Because the LLW standards will be developed under the Atomic Energy Act of 1954, as amended, consideration of costs and benefits and determination of ALARA are important parts of our technical program. EPA's approach to defining the alternatives, evaluating the benefits (i.e., reduction in health risks), and determining the costs and potential economic impacts of the LLW standards are discussed. 23 references, 3 figures, 1 table.

19747 (CONF-8308106—, pp 52-61) **Low-level radioactive waste program of the US Geological Survey - in transition.** Fischer, J.N. (Geological Survey, Reston, VA). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

In 1983, the US Geological Survey will publish final reports of geohydrologic investigations at five commercial low-level, radioactive-waste burial sites in the United States. These reports mark the end of the first phase of the US Geological Survey program to improve the understanding of earth-science principles related to the effective disposal of low-level wastes. The second phase, which was initiated in 1981, is being developed to address geohydrologic issues identified as needing greater attention based upon results of the first-phase site studies. Specific program elements include unsaturated-zone hydrology, geochemistry, clay mineralogy, surface geophysical techniques, and model development and testing. The information and expertise developed from these and previous studies will allow the US Geological Survey to provide sound technical assistance to State low-level waste compacts, the Department of Energy, the Nuclear Regulatory Commission, and the Environmental Protection Agency. 11 references.

19748 (CONF-8308106—, pp 62-88) **Management of low-level radioactive wastes around the world.** Lakey, L.T. (Pacific Northwest Lab., Richland, WA); Harmon, K.M.; Colombo, P. 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Low-level radioactive wastes are produced worldwide from nuclear power programs, weapon material activities, and institutional/industrial use of radioisotopes. The relative quantities produced by each source are dependent upon the scope of nuclear activities in a country. Classical engineering processes-evaporation, ion exchange, precipitation, compaction, incineration-are commonly employed to reduce volumes. Immobilization is employed, but not universally, to fix the wastes for storage and/or disposal. Cement and bitumen are the most common fixation agents used. Indefinite storage in surface facilities and shallow-land burial are by far the most common means of disposal. Geologic disposal is used by four countries having land limitations or possessing a readily available repository (mine). Worldwide, the management of low-level radioactive wastes appears to offer no technical problems. Research and development is directed at optimizing site-specific practices and, in underdeveloped countries, introducing technology. Nontechnical issues, e.g., acceptance of disposal sites, are the focus of most interest. 73 references, 6 tables.

19749 (CONF-8308106—, pp 89-92) **DOE low-level waste management program management expectations.** Barainca, M.J. (Dept. of Energy, Idaho Falls, ID). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The Department of Energy, the Nuclear Regulatory Commission, the Environmental Protection Agency, and the United States Geologic Survey cooperate to develop programs which are compatible and minimize duplication. The reasons for supporting technology leading to the location of disposal sites generally fall into three categories: (1) minimize regulatory uncertainty; (2) establish and implement safety and environmental protection practices; and (3) improve cost efficiency. This meeting offers an opportunity for potential users of the information federal agencies, states, government contractors, and industry to review the program and provide feedback concerning the low-level waste program.

19750 (CONF-8308106—, pp 93-111) **Siting of a low-level radioactive waste disposal facility.** Alvarado, R.A. (Texas Low-Level Radioactive Waste Disposal Authority, Austin, TX). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The Texas Low-Level Radioactive Waste Disposal Authority was established by the 67th Legislature to assure safe and effective disposal of the state's low-level radioactive waste. The Authority operates under provisions of the Texas Low-Level Radioactive Waste Disposal Authority Act, VACS 4590f-1. In Texas, low-level radioactive waste is defined as any radioactive material that has a half-life of 35 years or less or that has less than 10 nanocuries per gram of transuranics, and may include radioactive material not excluded by this definition with a half-life or more than 35 years if special disposal criteria are established. Prior to beginning the siting study, the Authority developed both exclusionary and inclusionary criteria. Major requirements of the siting guidelines are that the site shall be located such that it will not interfere with: (1) existing or near-future industrial use, (2) sensitive environmental and ecological areas, and (3) existing and projected population growth. Therefore, the site should be located away from currently known recoverable mineral, energy and water resources, population centers, and areas of projected growth. This would reduce the potential for inadvertent intruders, increasing the likelihood for stability of the disposal site after closure. The identification of potential sites for disposal of low-level radioactive waste involves a phased progression from statewide screening to site-specific exploration, using a set of exclusionary and preferential criteria to guide the process. This methodology applied the criteria in a sequential manner to focus the analysis on progressively smaller and more favorable areas. The study was divided into three phases: (1) statewide screening; (2) site identification; and (3) preliminary site characterization.

19751 (CONF-8308106—, pp 112-120) **Overview of shallow land burial technology - the EPRI handbook.** Rogers, V.C. (Rogers and Associates Engineering Corp., Salt Lake City, UT); Williams, R.F. 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

A complete plan for selecting low-level waste (LLW) disposal sites consists of an institutional phase, a concept identification and site screening phase, a site selection/facility design and licensing phase, and an operational phase. The Electric Power Research Institute's (EPRI) LLW Site Selection Demonstration Program in low-level waste disposal includes the development of an LLW handbook that addresses these phases and also briefly discusses facility costs and post-closure monitoring. The handbook is currently being updated and will contain additional specific information in each of the key areas. Related EPRI project work includes an examination of facility design with particular emphasis on trench cap design and analysis, trench subsidence, and trench release rates. Improvements are also being made to the nuclide migration models developed at EPRI. The improvements are in the areas of leach rates, direct external gamma-ray exposure pathway, groundwater transport and parameter sensitivity analysis. In addition, a systems approach is being applied to develop cost-effective performance evaluations and post-closure monitoring programs. 10 references, 2 figures.

19752 (CONF-8308106—, pp 160-166) **Study of trench covers to limit infiltration at waste disposal sites.** Johnson, T.M.; Larson, T.H.; Herzog, B.L.; Cartwright, K.; Stohr, C.J. (Illinois State Geological Survey, Champaign). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The Illinois State Geological Survey is currently studying the use of layered covers to limit infiltration at shallow land-burial waste disposal sites. This paper discusses the preliminary results of computer modeling and laboratory experiments of infiltration through various types of cover design. Based on the results of laboratory tests and computer modeling, four layered-soil cover designs were selected for field-scale tests in experimental trenches at the Sheffield, Illinois site. Construction of the experimental trench covers was recently completed. The geologic materials selected include Peoria Loess, Tiskilwa Till, and pea gravel. 12 references. (ATT)

19753 (CONF-8308106—, pp 167-179) **Performance of shallow land burial trench caps - assessment of the soil arch and soil beam concept.** McCray, J.G.; Nowatzki, E.A.; Thompson, G.M. (Univ. of Arizona, Tucson). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

During the past twenty three months the University of Arizona has constructed nine (9) shallow land burial trenches of uniform size (10' x 10' x 20') at two different locations with different environments. The scope of the work covers an evaluation of certain trench cap designs by structural and hydraulic monitoring under the stress conditions of an artificially created void space representing decomposed waste. The past eleven (11) months the contract was modified to structurally and hydraulically monitor only the three (3) trenches at the mountain site and, in addition, to construct a trench with a wick design similar to that being tested in another project at Sheffield, Illinois. The new trench with the wick also has an improved soil beam design. The tests to date indicate that neither of the two tested concepts (Soil Arch and Soil Beam) worked well in dry sandy type of soils; but, they appear to be more successful in the clay/loam soils with higher moisture content. 6 figures, 5 tables.

19754 (CONF-8308106—, pp 180-192) **Geochemical investigations at shallow land burial sites.** Dayal, R.; Arora, H.; Pietrzak, R.F. (Brookhaven National Lab., Upton, NY). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

A field and laboratory research program is under way to investigate the geochemical characteristics of existing commercial low-level radioactive waste burial sites. This investigation provides source-term data on radionuclides and other solutes in trench leachates and will also help identify key geochemical controls on trench leachate chemistry and radionuclide mobility. These objectives are being pursued in three task areas: (1) trench leachate characterization, (2) radionuclide migration studies, and (3) waste form leaching under simulated trench environments. Results of these research activities are presented and discussed. 9 references, 5 figures, 2 tables.

19755 (CONF-8308106—, pp 225-239) **In situ vitrification of transuranic wastes: systems evaluation and applications assessment.** FitzPatrick, V.F.; Brown, D.R.; Buelt, J.L.; King, S.E.; Napier, B.A.; Oma, K.H.; Silviera, D.J.; Timmerman, C.L. (Pacific Northwest Lab., Richland, WA). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

In situ vitrification is an emerging technology, suitable for the stabilization of buried radioactive waste. In just under three years in situ vitrification has moved from a concept tested in the laboratory to an achievable reality, with a series of 18 laboratory (engineering-scale) tests and 7 field (pilot-scale) tests. A radioactive make-up site of TRU wastes and mixed fission products has been stabilized with the pilot-scale system. In this test, approximately 25 kg of contaminated soil, containing about 600 nCi/g of ^{230}Pu/^{241}Am, was successfully vitrified without release of radionuclides to the environment. The ISV tests have been supplemented by public and occupational exposure calculations which show that releases fall below the limits set by the federal govement for both routine and accident conditions. Performance analysis has verified the process effectiveness in terms of preventing the migration of radionuclides into the biosphere in the far-distant (1000 and 10,000 year) future under an array of intrusion scenarios including inadvertent and deliberate human intrusion. Cost analyses have shown that for both Hanford and a generic site, processing costs are less than the cost of disposal of low-level waste at US Department of Energy disposal sites. 14 references, 5 figures, 8 tables.

19756 (CONF-8308106—, pp 240-253) **Low-level waste disposal site geotechnical subsidence corrective measures: technical progress.** Phillips, S.J.; Winterhalder, J.A.; Gilbert, T.W. 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

A geotechnical test facility has been constructed at the Hanford Site Richland Site Richland, Washington. The purpose of this facility is to quantitatively evaluate the performance of alternative technologies to ameliorate geomechanical subsidence in solid waste burial structures. Alternatives to be tested include; accelerating mass ground surface impact, and two optional subsurface rod injection/withdrawal techniques. The alternatives involve the principle of dynamic consolidation of buried waste and matrix materials. A description of the geotechnical test facility, the monitoring instrumentation used therein, laboratory soil mechanics data evaluation, and facility baseline monitoring data are presented. 6 references, 5 figures.

19757 (CONF-8308106—, pp 254-268) **Insights gained from NRC research investigations at the Maxey Flats LLW SLB facility.** O'Donnell, E. (Nuclear Regulatory Commission, Washington, DC). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The NRC funded program of research at Maxey Flats was done to assist an Agreement State in assessing the performance of the site. That program has yielded both site specific insights and generic insights which are likely to be useful in licensing future sites. They are as follows: Site Specific Insights: (1) The principal pathway of water entry into burial trenches at Maxey Flats is through the trench caps. (2) Sampling of vegetation, soils, and streams adjoining the site indicates that the small but measureable amounts of radionuclides found offsite were from surface runoff or the site

evaporator. (3) There is limited onsite subsurface movement of radionuclides where open fractures intersect burial trenches. Generic Insights: (1) Tritium in the plant transpiration stream appears useful for mapping trench boundaries. (2) Trees offer a promising means of monitoring subsurface radionuclide movement in fractured rocks of low permeability. (3) Complexing with EDTA appears to be a potentially important mechanism that increases mobility of such radionuclides as Co-60, Pu-238, Am-241, and Sr-90. (4) Changes in soil solution chemistry encountered as leachate moves from trenches generally reduce the solubility of migrating radionuclides. (5) Agronomic management techniques appear promising as a means to control deep water percolation through waste burial trench caps. 18 references.

19758 (CONF-8308106—, pp 269-290) **Infiltration barrier demonstration at Maxey Flats, Kentucky.** Mills, D. (Kentucky Natural Resources and Environmental Protection Cabinet, Frankfort, KY); Razor, J. 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

At the 1982 DOE LLWMP meeting, the Kentucky Natural Resources and Environmental Protection Cabinet presented a history of the Maxey Flats Waste Disposal Facility, its status, and current Commonwealth activities leading toward stabilization and decommissioning. Information was presented at that time on the purpose of the DOE Trench Moisture Barrier Demonstration Grant and the early phases of construction and implementation. In this paper, final construction and implementation of the trench moisture barrier demonstration are discussed. Data including trench water level measurements, lateral liquid flow in experimental sections, and soil moisture measurements are presented and discussed. The Paper is completed with a brief discussion of remediation activities currently being implemented at Maxey Flats. 9 references, 7 figures, 1 table.

19759 (CONF-8308106—, pp 291-307) **Analysis of alternatives for greater confinement disposal.** Gilbert, T.L.; Luner, C. (Argonne National Lab., IL). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

A method for ranking and scaling alternatives for greater-confinement disposal of high-activity LLW using benefit-cost-risk analysis is presented. The alternatives considered are representative generic facilities that span the range from conventional disposal facilities for LLW to those under consideration for HLW. Benefits are assumed to be common to all alternatives; hence the benefit-cost-risk analysis reduces to a problem of evaluating-for each alternative and a unit quantity of greater-confinement-disposal waste-a ranking parameter, RP = C + H, where C is the cost in dollars and H is the health risk converted to dollars. Ranking and scaling depend only on ranking parameter differences; common errors in cost and risk estimates do not, therefore, affect the ranking and scaling of alternatives. An example is given of use of the analysis for a generic cost-risk assessment of greater-confinement alternatives co-located with a shallow-land burial facility. 16 references, 7 tables.

19760 (CONF-8308106—, pp 316-324) **Greater confinement disposal test Fiscal Year 1983 progress.** Dickman, P.T. (Reynolds Electric and Engineering Co., Las Vegas, NV); Boland, J.R. 1983. NTIS, PC A99/MF A01. Contract AC08-76NV00410.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The Greater Confinement Disposal Test (GCDT) at the Nevada Test Site will demonstrate the use of large diameter boreholes for the disposal of low-level wastes considered unsuitable for shallow land burial. During FY 1983 we completed constructing and instrumenting the GCDT and started testing the tracer system at the Shallow Test Plot calibration facility. Also, the remote waste handling system was designed and fabricated. Information is presented on the remote waste handling system's design and operating requirements. The GCDT tracer monitoring system's development and potential site characterization applications are also discussed. Some early results of the gaseous tracer and tritium source term experiments are reported. 5 figures.

19761 (CONF-8308106—, pp 325-337) **Properties of radioactive wastes and waste containers.** Arora, H.; Swyler, K.J.; Dayal, R. (Brookhaven National Lab., Upton, NY). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

This NRC sponsored program addresses basic concerns for licensing radioactive waste forms and containers in terms of their potential for radionuclide release and dimensional stability. Major tasks in the program include performance evaluation of (1) waste forms based on laboratory testing of simulated and reactor waste, and (2) high-integrity radwaste container materials. A scale-up study to estimate Cs-137 release from simulated ion-exchange resin and boric acid waste composites was completed. Experiments to study the leach behavior of Prairie Island (boric acid) and Brunswick (ion-exchange resin) reactor waste composites are under way. Additional experiments are in progress to determine waste form leachability under varying wet-dry cyclic conditions. Laboratory tests are also under way to examine the effect of various aging processes on the mechanical and chemical properties of high-density polyethylene, a radwaste container material. 7 references, 6 figures, 1 table.

19762 (CONF-8308106—, pp 338-348) **Waste classification system application.** Wickham, L.E. (EG & G Idaho Inc., Idaho Falls). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The classification of materials based on total hazard could be a very useful measurement tool to aid in waste management decisions. This paper describes a waste classification system that evaluates the relative total hazard of chemical and radiological waste mixtures and provides guidance on the degree of isolation each waste type or shipment needs. The index considers the hazards of materials based on intrinsic toxicity, persistence through time, availability to a human receptor, and build up of decay products. The index has been applied to a number of materials to test its versatility and applicability. Examples are provided. 4 tables.

19763 (CONF-8308106—, pp 359-380) **Investigations of potential below regulatory concern (de minimus) wastes.** Gruhlke, J.M.; Galpin, F.L. (Environmental Protection Agency, Washington, DC). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Low-level radioactive waste (LLW) includes a wide variety of waste types. Many organizations are contemplating the merits of declaring certain LLW as de minimus. The concept of de minimus has considerable support, as evidenced by the comments on NRC's rulemaking for 10 CFR Part 61, Licensing Requirements for Land Disposal of Radioactive Waste. Practical and philosophical considerations lend weight to the further investigation of the de minimus concept for LLW. The Environmental Protection Agency (EPA) recognizes the interest and efforts in the concept of de minimus. Because the term de minimus may imply a lack of concern for the risks of disposal, we use the term Below Regulatory Concern (BRC). EPA has developed technical information, cost data, and a methodology for selecting promising candidate waste streams. The NRC's breakdown of LLW, as provided in the supporting documentation for 10 CFR Part 51, serves as a starting point for evaluating individual waste streams. Waste streams may then be ranked on the basis of individual dose, population health impact, and cost/benefit. A set of waste streams consistently ranks near the top in all categories and deserves further analysis. This screening is the initial step in an overall effort to develop a basis for determining the appropriateness and form of generic BRC criteria. 14 references, 8 tables.

19764 (CONF-8308106—, pp 404-428) **Long-lived radionuclides in low-level waste.** Cline, J.E.; Coe, L.J. (Science Applications, Inc., Rockville, MD). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

In July 1982, the Low-Level Waste Licensing Branch of the NRC, anticipating the impact of the proposed Part 61 to 10 CFR, funded a two-year project by SAI to study the radionuclide contents of LWR generated in low-level waste. The objectives of the study are: (1) to analyze, using verified techniques, 150 archived samples for specified beta- and x-ray-emitting nuclides that had not previously been analyzed; (2) to analyze twenty new samples obtained from operating plants for all relevant nuclides and compare them to previous data to ascertain trends; (3) to develop empirical scaling factors through the use of which concentrations of hard-to-analyze nuclides can be estimated from analyses of the gamma-ray emitting nuclides. The new samples are analyzed and the results are summarized and interpreted. Over fifty archived samples have also been analyzed. We discuss scaling factor development. Factors are presented that relate ^{63}Ni and ^{59}Ni to ^{60}Co for PWRs and to ^{58}Co for BWRs, ^{90}Sr to ^{137}Cs for BWRs and ^{241}Pu, ^{239}Pu, ^{241}Am, and ^{244}Cm to ^{144}Ce for all LWRs. 8 figures, 3 tables.

19765 (CONF-8308106—, pp 429-440) **Stability testing of low-level waste forms.** Piciulo, P.L.; Shea, C.E.; Barletta, R.E. (Brookhaven National Lab., Upton, NY). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The NRC Technical Position on Waste Form identifies methods for thermal cycle testing and biodegradation testing of low-level waste forms. These tests were carried out on low-level waste forms to establish whether the tests are reasonable and can be achieved. The thermal cycle test is believed adequate for demonstrating the thermal stability of solidified waste forms. The biodegradation tests are sufficient for distinguishing materials that are susceptible to biodegradation. However, failure of either of these tests should not be regarded of itself as a indication that the waste form will biodegrade to an extent that the form does not meet the stability requirements of 10 CFR Part 61. 9 references, 4 figures, 5 tables.

19766 (CONF-8308106—, pp 494-503) **Low-level nitrate waste process development.** Meile, L.J.; Johnson, A.J. (Rockwell International, Golden, CO). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Chemical methods of denitrification of simulated low-level nitrate wastes were investigated on a laboratory scale. Various reducing agents and catalysts were tested in evaporation and drying experiments to determine denitrification efficiency, NO/sub x/ off-gas generation, and future process applicability. A peer review was conducted to gain input on processing needs and preferences from actual nitrate waste generators. Experimental results are discussed and conclusions presented. 3 references, 10 tables.

19767 (CONF-8308106—, pp 504-528) **High integrity container development.** Tuite, P.T. (Waste Management Group Inc., Croton on Hudson, NY). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

A high-density polyethylene 55-gallon drum radwaste container is being developed. The objective of this project is to design and test a low cost open top polyethylene drum which can also be used as a high integrity container. The container consists of a commercially available closed top 55-gallon drum which when modified with an open top closure and insert will qualify as a high integrity container. Container development and testing is based on the recently published NRC criteria for high integrity containers and DOT's new regulations for Type A packages. The container design effort as well as preliminary testing has been completed. Fabrication of several different prototype configurations and final testing will be performed. 4 references, 2 figures, 2 tables.

19768 (CONF-8308106—, pp 650-658) **US Geological Survey studies of commercial low-level radioactive waste disposal sites - a summary of results.** Fischer, J.N. (Geological Survey, Reston, VA). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The US Geological Survey has completed geohydrologic investigations of five commercial low-level, radioactive-waste disposal sites. Final reports on two of the sites have been released and the remaining three will be, published this year. A highly permeable glacial sand, originally thought to be discontinuous, has proven to be continuous in narrow channel deposits at the site near Sheffield, Illinois. These deposits have provided pathways for tritium-contaminated ground water to move off site. At another site, near West Valley, New York, the distribution and geohydrologic characteristics of the fine-grained glacial sediments have been studied and documented. Contaminants have not been detected in ground water away from the site. Studies at the Maxey Flats, Kentucky site, indicated that only 0.1 inches of precipitation percolates through bedrock from the site to the valley floor annually. Investigations at the arid Beatty, Nevada site, have been directed toward the geohydrologic characterization of unaturated sediments at the site. A significant finding of geohydrologic investigation of the Barnwell, South Carolina site, was that cobalt 60 in ground water percolating through the bottom of one trench diminished to undetectable levels of concentration within 6 feet of the trench bottom. This fact suggests that soil characteristisc at the site are effective in impending transport of that, and perhaps other, radionuclides. 6 references.

19769 (CONF-8308106—, pp 669-673) **Preliminary results of a study of the unsaturated zone at the low-level radioactive waste disposal site near Sheffield, Illinois.** Healy, R.W. (Geological Survey, Urbana, IL). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Preliminary results of studies of the unsaturated zone at the low-level radioactive waste disposal site near Sheffield, Illinois, include: (1) Infiltration into trenches generally occurs only in late fall or spring. (2) Most of the water that enters trenches infiltrates in the swales between adjacent trench caps. (3) Movement of water downward to the saturated zone is a slow process characterized by small changes in soil-moisture content and soil-water tension in the vicinity of the trench floors. Quantification of this process is complicated by the complex layering of the different glacial deposits which comprise the unsaturated zone. (4) Tritium, in the form of water, is the only radionuclide present in the soil water in concentrations above background. Soil-water tensions, soil temperatures, and soil-gas pressures are monitored continuously at several depths within and adjacent to a trench cap and beneath four trenches. Access beneath the four trenches is provided by a 122-meter long tunnel. Soil-moisture contents are measured and soil-water samples obtained on a weekly basis. Tracers are being used to aid in determining the rate and directions of water movement in the unsaturated zone. A micrometeorological station is instrumented to obtain atmospheric measurements from which evapotranspiration is computed.

19770 (CONF-8308106—, pp 674-692) **Study of unsaturated zone hydrology at Maxey Flats.** Schulz, R.K. (Univ. of California, Berkeley). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The principal efforts of this work have been directed to the determination of the pathway(s) of water entry into waste burial trenches at Maxey Flats and to investigate possible countermeasures for minimizing the entry of water into the waste burial trenches. In addition, transport of buried ^{3}H to the atmosphere by plant uptake and leaf transpiration has been under investigation during the past

year. Possible use of plant uptake as an indicator for mapping of trench boundaries has also been studied during the past year. A lysimeter experiment designed to investigate possible mitigation of water entry into the low level waste burial trenches by use of improved management practices is underway at the Maxey flats site. 9 figures, 2 tables.

19771 **(CONF-8308126—5) Physical response of backfill materials to mineralogical changes in a basalt environment.** Couture, R.A.; Seitz, M.G. (Argonne National Lab., IL (USA)). 1983. Contract W-31109-ENG-38. 28p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009204.

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Backfill materials surrounding waste canisters in a high-level nuclear waste repository are capable of ensuring very slow flow of groundwater past the canisters, and thereby increase the safety of the repository. However, in the design of a repository it will be necessary to allow for possible changes in the backfill. In this experimental program, changes in permeability, swelling behavior, and plastic behavior of the backfill at the temperatures, pressures, and radiation levels expected in a repository are investigated. The emphasis is on investigation of relevant phenomena and evaluation of experimental procedures for use in licensing procedures. The permeability of a slightly compacted sand-clay mixture containing 25% bentonite, with a dry bulk density of 1.59 g/cm^3, was determined to be 0.9 x 10^{-18} m^2 in liquid water at 25 and 200°C, respectively. This is sufficiently low to demonstrate the potential effectiveness of proposed materials. In practice, fractures in the host rock may form short circuits around the backfill, so an even lower flow rate is probable. However, alteration by any of several mechanisms is expected to change the properties of the backfill. Crushed basalt plus bentonite is a leading candidate backfill for a basalt repository. Experiments show that basalt reacts with groundwater vapor or with liquid groundwater producing smectites, zeolites, silica, and other products that may be either beneficial or detrimental to the long-term performance of the backfill. Concentration of groundwater salts in the backfill by evaporation would cause immediate, but possibly reversible, reduction of the swelling abaility of bentonite. Moreover, under some circumstances, gamma radiolysis of moist air in the backfill could produce up to 0.5 mole of nitric acid or ammonia per liter of pore space. 27 references, 7 figures, 4 tables.

19772 **(DOE/ER/10108—T1) Gorleben international review: request for additional information.** Cochran, T.B. (Natural Resources Defense Council, Inc., Palo Alto, CA (USA)). 29 Aug 1978. Contract AC01-78ER10108. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007679.

Questions and requests for information are presented which are directed to the Reactor Safety Commission (RSK) and Radiological Protection Commission (SSK) on the partial project 6-final waste storage, and to the DWR on the disposal center for spent nuclear fuel elements.

19773 **(DOE/ER/10108—T2) Radioactive waste disposal criteria.** Cochran, T.B. (Natural Resources Defense Council, Inc., Washington, DC (USA)). 31 May 1978. Contract AC01-78ER10108. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010219.

This paper attempts to establish early a set of fundamental radioactive waste disposal criteria which will guide and constrain the more technical and narrowly defined criteria which will inevitably follow. Draft criteria are presented followed by a discussion of the rationale. Briefly stated the criteri are: (1) waste management or disposal scheme of choice should be just to future generations; (2) in assessing the adequacy of radioactive waste management or disposal schemes, or in comparing waste management of disposal alternatives, risk-benefit analysis is an inappropriate tool and should not be the principal basis for evaluating decisions; (3) safety to future generations is a primary concern, and should always take precedence over cost; (4) objective of geologic disposal of high-level radioactive waste should be the permanent isolation of the waste from any future possible contact with living organisms; (5) there should be high confidence that the cumulative risk to all future generations from radioactive waste should be less than, or comparable to, the cumulative risk to all future generations from the original uranium resources from which the radioactive wastes were derived; (6) there should be a high confidence that concentrations of radionuclides in waste materials should not be allowed to appear in the earth's biosphere before they have decayed to innocuous levels; (7) geologic medium and site selected for geologic disposal should be selected to minimize the possibility of future human intrusion during periods after which the permanence of records can no longer be relied upon; (8) radioactive waste should be stored in a retrievable manner for the period during which the repository is open, or until it can be assured with high confidence that all waste disposal criteria are met, whichever is the longer period. 11 references.

19774 **(DOE/ER/10108—T3) Nuclear waste: too much too soon.** Cochran, T.B.; Tamplin, A.R. (Natural Resources Defense Council, Inc., Palo Alto, CA (USA)). 1978. Contract AC01-78ER10108. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84010215.

While it is agreed that now is the time to find a solution to the disposal of radioactive wastes which are stored in tanks and are, at the same time, accumulating at an increasing rate at nuclear power reactor, it is not the time for hurried and inappropriate action. To illustrate the magnitude of the problem, this report begins with a discussion of the looming logistical problem involving the management of nuclear waste materials. This is followed by the historical background of the nuclear bureaucracy and industry that will be charged with the responsibility of disposition of the waste. The report concludes with a discussion of the evolving criteria for waste disposal and the depressing implication of this evolution. This report is intended as an environment alert to call this problem to the attention of the citizenry and Congress and to indicate that their close involvement in its solution is absolutely essential. 23 references, 2 figures.

19775 **(DOE/ER/30042—T1) Study of research needs and priorities in radioactive waste management.** Carson, W.E.; Mitchell, W. III. (Southern Science, Dunedin, FL (USA)). Feb 1984. Contract AC01-82ER30042. 74p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009045.

This report presents the results of an assessment of long-range research needs in nuclear waste management. The purpose is to aid the Director of Energy Research in determining the health of DOE's research programs. The intent of the project reported here was to identify additional, basic research necessary in the 1980s and 1990s to develop an adequate scientific data base for nuclear waste management activities likely to be important around the turn of the century. The recommendations resulted from an overview of the entire area of nuclear waste management, not from focused examinations of narrow topics within that area. The suggested research may be the subject of future studies or more intense work by DOE. The recommendations presented in this report are not accompanied by designations of responsible program offices within DOE. It is anticipated that the contents of the report will be shared with the program offices involved and that those offices will recognize and respond to recommendations within their purviews.

19776 **(DOE/NV/10282—T4) Proposed nomination of Yucca Mountain as a potential high-level radioactive waste repository. Registration and transcript of proceedings of US Department of Energy public hearings, Las Vegas, Nevada, March 1983.** (EG and G, Inc., Las Vegas, NV (USA)). 1983. Contract AC08-83NV10282. 153p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84009317.

The purpose of this public hearing were: (1) to solicit comments on the nomination of Yucca Mountain for site characterization as a potential high-level radioactive waste repository; (2) to solicit issues to be included in an Environmental Assessment supporting the Department's formal nomination of that site; and (3) to solicit issues to be addressed in the Site Characterization Plan which would subsequently be issued prior to proceeding with site characterization. The public hearing utilized a panel comprising of three persons, including a chairperson, who were not employees of the

Department of Energy, and who had not participated in the preparation of the proposed nomination of Yucca Mountain. This volume contains statements from 29 participants, beginning with those of the Governor of Nevada.

19777 **(DOE/NV/10282—T5) Proposed nomination of Yucca Mountain as a potential high-level radioactive waste repository. Correspondence and request for oral presentations for US Department of Energy public hearings.** (EG and G, Inc., Las Vegas, NV (USA)). 1983. Contract AC08-83NV10282. 132p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84009316.

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This volume contains correspondence and requests by the public citizens for oral presentation at the public hearings for the proposed nomination of Yucca Mountain as a potential high-level radioactive waste repository. Written comments are also included on: the proposed nomination; the issues to be addressed in the Environmental Assessment; and the issues to be addressed by any Site Characterization Plan, if developed.

19778 **(DOE/UMT—0214) Asphalt emulsion radon barrier systems for uranium mill tailings: an overview of the technology.** Baker, E.G.; Hartley, J.N.; Freeman, H.D.; Gates, T.E.; Nelson, D.A.; Dunning, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 144p. (PNL—4840). NTIS, PC A07/MF A01; GPO Dep. Order Number DE84010103.

Pacific Northwest Laboratory (PNL), under contract to the US Department of Energy (DOE) Uranium Mill Tailings Remedial Action Project (UMTRAP) office, has developed an asphalt emulsion cover system to reduce the release of radon from uranium mill tailings. The system has been field tested at Grand Junction, Colorado. Results from laboratory and field tests indicate that this system is effective in reducing radon release to near-background levels (<2.5 pCi $m^{-2}s^{-1}$) and has the properties required for long-term effectiveness and stability. Engineering specifications have been developed, and analysis indicates that asphalt emulsion covers are cost-competitive with other cover systems. This report summarizes the technology for asphalt emulsion radon barrier systems. 59 references, 45 figures, 36 tables.

19779 **(EPRI-NP—3222) Proceedings: 1983 ASME-EPRI radwaste workshop.** Coplan, B.V. (ed.). (BVC Consultants, Inc., Sun City Center, FL (USA)). Aug 1983. 112p. (CONF-830162—). Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

From ASME-EPRI radwaste workshop; Charlotte, NC, USA (31 Jan 1983).

The proceedings of the fifth ASME-EPRI jointly sponsored radwaste workshop are presented. This year's meeting had the workshop themes of Liquid Radwaste Treatment, Waste Management Planning for Outages and Effect of Decontamination on Radwaste. In addition to the program presentations, a summary of EPRI's low-level radioactive waste program, a discussion of measurement methods for compliance with 10CFR 61 and summaries of the workshop proceedings on the meeting's themes are included in the proceedings. Individual papers are abstracted for inclusion in the Energy Data Base.

19780 **(NUREG/CR—3699) Summary of computer codes for waste package performance assessment.** Coffman, W.; Vogt, D.; Mills, M. (CorSTAR Research, Inc., Bethesda, MD (USA)). Mar 1984. 314p. NTIS, PC A14/MF A01 - GPO* $7.50. Order Number DE84901014.

This is the fourth in a series of five reports that will provide critical reviews and summaries of computer programs that can be used to analyze the potential performance of a high-level radioactive waste repository. The computer programs identified in this report address the performance of a waste package, including the areas of thermal analysis, structural analysis, and special purpose programs. The report provides a summary description of 19 computer programs. Fourteen of these computer programs are being used by the US Department of Energy or the US Nuclear Regulatory Commission to analyze various aspects of waste package performance. The remaining five codes can be used to analyze phenomena that may be important in waste package performance. 7 references, 15 tables.

19781 **(ORNL/TM—8960) Hydrologic study and evaluation of Ish Creek watershed (West Chestnut Ridge proposed disposal site).** Huff, D.D.; Elmore, J.L.; Farmer, D.C. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009117.

As part of site characterization work for the proposed West Chestnut Ridge Central Waste Disposal Facility, hydrologic information has been assembled from literature sources and direct field measurements. Earlier studies provide the basis for estimating flow frequency and expected high and low flows for catchments on Knox Group formations. Seven waterflow-gaging installations were established and used to characterize runoff patterns in the study area. Based on findings of this study, a practical design capacity for a flume to measure site runoff would range between 1 and 3000 L/s, although flows up to 4500 L/s (10-year recurrence interval) may be encountered. 7 references, 2 figures, 5 tables.

19782 **(PB—84-136514) Application of electrical and thermal borehole logging to structural and hydrogeological investigations of crystalline bedrock. Research report.** Poikonen, A. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1984. 91p. NTIS, PC E05/MF E01.

In the study electrical and thermal borehole-geophysical techniques are applied to bedrock investigations connected with geological disposal of nuclear waste. The results are also applicable to other engineering purposes where structural and hydrogeological information of bedrock is needed. The study is based on the geophysical measurements carried out at the Loviisa and Olkiluoto nuclear power plant sites. The measurements are part of the site investigation the purpose of which is to assess the suitability of the bedrock for final disposal of low-level and intermediate-level reactor wastes. The specific objectives of the geophysical investigations are to map and characterize fractures and to examine the hydrogeological conditions beneath the sites.

19783 **(PNL—3594-Rev.4) International nuclear fuel cycle fact book. Revision 4.** Harmon, K.M.; Lakey, L.T.; Leigh, I.W. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 285p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84008529.

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This Fact Book has been compiled in an effort to provide (1) an overview of worldwide nuclear power and fuel cycle programs and (2) current data concerning fuel cycle and waste management facilities, R and D programs, and key personnel in countries other than the United States. Additional information on each country's program is available in the International Source Book: Nuclear Fuel Cycle Research and Development, PNL-2478, Rev. 2. The Fact Book is organized as follows: (1) Overview section - summary tables which indicate national involvement in nuclear reactor, fuel cycle, and waste management development activities; (2) national summaries - a section for each country which summarizes nuclear policy, describes organizational relationships and provides addresses, names of key personnel, and facilities information; (3) international agencies - a section for each of the international agencies which has significant fuel cycle involvement; (4) energy supply and demand - summary tables, including nuclear power projections; (5) fuel cycle - summary tables; and (6) travel aids - international dialing instructions, international standard time chart, passport and visa requirements, and currency exchange rate.

19784 **(PNL—4945) INFIL1D: a quasi-analytical model for simulating one-dimensional, constant flux infiltration.** Simmons, C.S.; McKeon, T.J. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1984. Contract AC06-65RL01830. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008905.

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The program INFIL1D is designed to calculate approximate wetting-front advance into an unsaturated, uniformly moist, homogeneous soil profile, under constant surface-flux conditions. The code is based on a quasi-analytical method, which utilizes an assumed invariant functional relationship between reduced (normalized) flux and water content. The code uses general hydraulic property data in tabular form to simulate constant surface-flux infiltration. 10 references, 4 figures.

19785 **(RHO-BW-SA—302AP) Dissolution of borosilicate glass in the presence of basalt and groundwater at 300 bars and 100° to 300°C.** Holloway, J.R.; Clemens, J.D. (Arizona State Univ., Tempe (USA)). Jun 1983. Contract AC06-80RL01030. 3p. (CONF-8305180—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE83014644.

From American Geophysical Union meeting; Baltimore, MD, USA (30 May 1983).

Borosilicate glass, PNL 76-78, a simulated waste form for nuclear waste disposal, was reacted together with a Columbia River tholeiitic basalt and synthetic groundwater in modified Dickson-type rocking autoclaves. These experiments were performed to determine the suitability of disposing borosilicate glass in a nuclear waste repository located in basalt. Solutions were sampled periodically over durations of one month at 300°C, three months at 200°C, and seven months at 100°C. Water:solid mass ratio was 10:1. From the observations on the solutions and solid phases it appeared that significant dissolution, reaction, and precipitation occurred at 200° and 300°C, but that only dissolution occurred at 100°C. The lack of precipitation of daughter phases or reaction of solution with the basalt at 100°C caused all elements released from the borosilicate glass to remain in solution. This is interpreted to be caused by kinetic limitations on the nucleation of daughter phases. The average dissolution rate at 100°C was roughly 0.5 g glass per liter groundwater per square meter of glass surface per month.

19786 **(SAND—82-1774) Software for Applicon graphics system support of the NNWSI area-to-location screening activity.** Sharp, M.W. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1984. Contract AC04-76DP00789. 116p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84009506.

A comprehensive system study has been performed to screen the Nevada Research and Development Area (NRDA) of the Nevada Test Site (NTS) and nearby areas for relatively favorable locations of about 10 square miles for the permanent disposal of radioactive waste in a mined repository. The purpose of this screening was to use information available during the summer of 1981 to identify such locations. The results of this screening will allow more informed decisions by the Department of Energy's Nevada Nuclear Waste Storage Investigations Project as to where future repository exploration could be concentrated to optimize the chances that the locations chosen for characterization would qualify as a licensed repository site. The methods used for, and the results of, this study are described by S. Sinnock and J. Fernandez in their report, Summary and Conclusions of the NNWSI Area-to-Location Screening Activity (NVO-247). This report is intended to describe the computer support developed for the screening activity and, as such, should not be treated as a stand-alone document, but as a supplement to the above summary report. This report complements two other supplemental reports dealing with 16 physical data bases for screening and the objectives of the screening methodology. Together, these four reports fully describe the screening activity of the Nevada Nuclear Waste Storage Investigations Project.

19787 **(SAND—83-2507C) Field tests of stress measurement techniques in rock salt.** Stormont, J.C.; Matalucci, R.V.; Morgan, H.S. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 26p. (CONF-840577—4). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009489.

From 30. international instrumentation symposium; Denver, CO, USA (7 May 1984).

Three underground field tests were performed in southeastern New Mexico as part of the US Department of Energy's Waste Isolation Pilot Plant (WIPP) Research and Development Program. These tests, one in potash-rich halite and two in relatively pure halite (rock salt), investigated the feasibility of using borehole inclusion stressmeters to measure in situ stress and stress changes in salt. The tests provided a comparison of inclusion stressmeters and demonstrated various qualities of gage response, including time-dependent characteristics, repeatability, and the effects of preload. Three gage types comprising five gages were used: (1) the strain-gaged stressmeter (SGS); (2) two US Bureau of Mines (USBM) hydraulic pressure cells called the borehole pressure cell (BPC) and the cylindrical pressure cell (CPC); and (3) two development pressure cells called the USBMX and the Sandia Pressure Cell (SPC). Gage response has been reasonably consistent. However, further study is required of the correlations between gage types and between gage output and the in situ state of stress. 13 references, 16 figures, 2 tables.

19788 **(SAND—84-0648C) WIPP: the proximate solution to defense waste disposal issues.** Weart, W.D. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 26p. (CONF-840455—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009445.

From Atomic Industrial Forum fuel cycle '84; Atlanta, GA, USA (1 Apr 1984).

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The Waste Isolation Pilot Plants (WIPP) is under construction in the salt beds of southeast New Mexico, with an anticipated completion date of December 1986. At present, shaft excavations continue with the enlargement of one existing shaft and sinking of a third. Underground excavation is underway to develop the room complex for rock mechanics and simulated defense high-level waste experiments. This report provides a project cost and schedule for major elements of the program, a summary of the WIPP design and capabilities, the site evaluation studies, and the planned in situ tests. 17 references, 9 figures.

19789 **(SAND—84-0704C) Natural language solution to a Tuff problem.** Langkopf, B.S.; Mallory, L.H. (Sandia National Labs., Albuquerque, NM (USA); Spectra Research Inst., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-8404120—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009491.

From Association of system 2000 users for technical exchange conference; Austin, TX, USA (30 Apr 1984).

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A scientific data base, the Tuff Data Base, is being created at Sandia National Laboratories on the Cyber 170/855, using System 2000. It is being developed for use by scientists and engineers investigating the feasibility of locating a high-level radioactive waste repository in tuff (a type of volcanic rock) at Yucca Mountain on and adjacent to the Nevada Test Site. This project, the Nevada Nuclear Waste Storage Investigations (NNWSI) Project, is managed by the Nevada Operations Office of the US Department of Energy. A user-friendly interface, PRIMER, was developed that uses the Self-Contained Facility (SCF) command SUBMIT and System 2000 Natural Language functions and parametric strings that are schema resident. The interface was designed to: (1) allow users, with or without computer experience or keyboard skill, to sporadically access data in the Tuff Data Base; (2) produce retrieval capabilities for the user quickly; and (3) acquaint the users with the data in the Tuff Data Base. This paper gives a brief description of the Tuff Data Base Schema and the interface, PRIMER, which is written in Fortran V. 3 figures.

19790 **(USGS-OFR—83-856) Geohydrologic data for test well USW H-6 Yucca Mountain area, Nye County, Nevada.** Craig, R.W.; Reed, R.L.; Spengler, R.W. (Geological Survey, Denver, CO (USA); Fenix and Scisson, Inc., Mercury, NV (USA)). 1983. Contract AI08-78ET44802. 39p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009351.

This report presents the following data for test well USW H-6: drilling operations, lithology, availability of borehole geophysical logs, water levels, future availability of core analyses, water chemistry, pumping tests, and packer-injection tests. The well is one of a series of test wells drilled in and near Yucca Mountain adjacent to the Nevada Test Site, Nye County, Nevada, in cooperation with the US Department of Energy. These investigations are part of the Nevada Nuclear Waste Storage Investigations to

identify suitable sites for underground storage of high-level radioactive wastes. Test well USW H-6 was drilled to a total depth of 1220 meters. Rocks penetrated are predominantly ash-flow tuffs. Lava was encountered from 877 to 1126 meters. The composite static water level is approximately 526 meters below land surface. The well was pumped during two periods. Maximum drawdown was about 18 meters after pumping for 4822 minutes at 28 liters per second, and 12 meters after pumping for 2226 minutes at 27 liters per second. A borehole flow survey showed that 91% of the water withdrawn from the well came from the depth intervals from 616 to 631 meters, and from 777 to 788 meters. 8 references, 18 figures, 6 tables.

19791 **(USGS-OFR—84-063) Geohydrologic data for test well USW G-4, Yucca Mountain area, Nye County, Nevada.** Bentley, C.B. (Geological Survey, Denver, CO (USA)). 1984. Contract AI08-78ET44802. 53p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84010085.

This report presents data on drilling operations, lithology, borehole geophysics, hydrologic monitoring, core analysis, water chemistry, pumping tests, and packer-injection tests for test well USW G-4. The well is one of a series of test wells drilled in and near the southwestern part of the Nevada Test Site, Nye County, Nevada, in cooperation with the US Department of Energy. These test wells are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for underground storage of high-level radioactive wastes. Test well USW G-4 was drilled to a total depth of 915 meters through volcanic rocks, consisting mostly of ash-flow tuff. Depth of water in the well during drilling and testing ranged from 538 to 544 meters below land surface. Static water level after completion of drilling was at an approximate altitude of 730 meters above sea level. Drawdown in the well was about 3 meters after test pumping more than 5000 minutes at a rate of 16 liters per second. A borehole-flow survey indicated that almost all water withdrawn from the well was contributed by the zone between a depth of about 865 and 915 meters below land surface. A composite water sample collected after well completion contained 216 milligrams per liter of dissolved solids, with relatively large concentrations of silica, sodium, and bicarbonate. 6 references, 21 figures, 6 tables.

19792 **(WINCO—1001) Iodine-129 process control monitor for evaporator off-gas streams.** Burr, J.R.; McManus, G.J. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Mar 1984. Contract AC07-84ID12435. 41p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009370.

Continuous monitoring of gaseous ^{129}I in evaporator off-gas at nuclear fuel reprocessing facilities is important from both regulatory and process control viewpoints. Accordingly, continuous monitoring of evaporator overheads would supply the necessary information retain ^{129}I in the evaporator bottoms should a process control mechanism for the evaporator be developed. Although a continuous ^{129}I monitor for nuclear fuel reprocessing plant off-gas streams has already been developed, monitoring of evaporator overheads presents unique problems for ^{129}I monitoring, including ^{129}I in the form of liquid aerosols, high concentrations of nitric acid mist and organics, and high concentrations of other radionuclides such as ^{137}Cs. The off-gas is also predominantly water vapor. A two-phase laboratory study was completed. First, the proper configuration to successfully detect ^{129}I was examined. Second, a 2^4 factorial design experiment was performed to determine the monitor's response to aerosols, organics, HNO_3, and ^{137}Cs. Both response and variability for the monitor were determined. Major conclusions were: the presence of HNO_3 had no statistically significant effect on the response of the monitor; the presence of TBP significantly increased the response of the monitor; the use of a filter, corresponding to low aerosol conditions, significantly increased the response of the monitor. A filter should be used because the decreased monitor response if the filter is not used (high aerosol conditions); under conditions of the experiments, ^{137}Cs remained in the evaporator bottoms; and no effect of ^{137}Cs on the monitor was observed; and the variability of the monitor was not significantly affected by the filter, TBP, HNO_3, or ^{137}Cs. The monitor when used with a filter, was considered suitable for use in evaporator off-gas streams.

19793 **Behavior of radionuclides in sanitary landfills.** Chang, K.C.; Chian, E.S.K.; Pohland, F.G.; Cross, W.H.; Roland, L.; Kahn, B. (Georgia Inst. of Tech., Atlanta). *Health Physics;* **46**: No. 1, 45-53(Jan 1984).

This study was undertaken to evaluate the possibility of disposing low-level radioactive waste in sanitary landfills with leachate containment to prevent environmental releases. To meet this objective, two simulated landfills, each 200 l. in volume and containing 55 kg of municipal refuse, were operated in the laboratory with simulated rainfall additions for a 9-month period to observe the extent to which radio-cobalt, -cesium, -strontium and tritium were leached into the liquid phase. One of the units was operated with leachate recycle, the other as a single pass control. Liquid samples were analyzed weekly for ^{3}H, ^{58}Co, ^{85}Sr and ^{134}Cs tracers. Weekly analyses were also performed for approximately 30 parameters to define the degree of stabilization of the waste. Major parameters included BOD, COD, pH and concentrations of specific organics, metals and gases. Concentrations of stable cobalt, strontium and cesium were also measured periodically. Soluble radioactivity levels in both systems were reduced by factors of 50 for ^{58}Co, 5 for ^{85}Sr and 7 for ^{134}Cs, taking radioactive decay and dilution into account. Some radionuclide removal from the liquid phase was associated with major chemical changes in the landfills that occurred within 80 days for the control systems and within 130 days for the recycle unit.

19794 **Development of a leach model for a commercial nuclear waste glass.** Kuhn, W.L.; Peters, K.D.; Simonson, S.A. (Pacific Northwest Laboratory, P.O. Box 999, Richland, Washington 99352). *Nuclear Technology;* **63**: No. 1, 82-89(Oct 1983). Contract AC06-65RL01830.

A leach model is presented for a commonly studied commercial nuclear waste glass, PNL 76-68. Boron release is taken to be a monitor of the reaction rate of the glass, while the actual releases of many other glass constituents into solution during static tests are evidently controlled by solubilities. The reaction rate determined in this way passes from linear to parabolic kinetics over the duration of the experiments analyzed, and boron concentrations in solution are found to be a function of the product of time and surface area-to-solution volume ratio. This behavior is found to be explained well by assuming the reaction is impeded by resorption of reaction products onto the reacting surface. Two model parameters are found as functions of temperature by fitting the model to published data. It is conluded that the accumulation of silica near the glass surface in a waste package in a repository could limit the rate of reaction of the glass, but not that the reaction would cease as silica reaches its solubility limit in solution.

19795 **Carbon steel canisters for the containment of nuclear waste.** Marsh, G.P. (Atomic Energy Research Establishment, Harwell Building 393 Didcot, Oxon). *Transactions of the American Nuclear Society;* **45**: 292(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19796 **Fundamental problems in general and pitting corrosion of iron and low-carbon steel containers under conditions expected in basalt and salt HLW repository environments.** McNeil, M.B. (U.S. Nuclear Regulatory Commission, Washington, DC 20555). *Transactions of the American Nuclear Society;* **45**: 292-294(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19797 **Evaluation of high-level waste package materials for use in crystalline rock repositories.** Nuttall, K. (Atomic Energy of Canada Limited, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba ROE 1LO). *Transactions of the American Nuclear Society;* **45**: 294(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19798 **Evaluation of high-level waste package materials for use in a repository in basalt.** Smith, M.J. (Rockwell Hanford Operations, P.O. Box 800, Richland, WA 99352). *Transactions of the American Nuclear Society;* **45**: 294-295(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19799 **Canister materials for a nuclear waste package in a tuff repository.** McCright, R.D.; Ballou, L.B. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **45**: 295-296(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19800 **Evaluation of high-level waste package materials for use in salt repositories.** Basham, S.J. Jr. (Battelle Office of Nuclear Waste Isolation, 505 King Avenue, Columbus, OH 43201). *Transactions of the American Nuclear Society;* **45**: 296-297(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19801 **Observed reduction of ^{222}Rn gas emanation from uranium tailings using a new chemical encapsulation process.** Mueller, J.J. (Controls for Environmental Pollution Inc., P.O. Box 5351, Sante Fe, NM 87502). *Transactions of the American Nuclear Society;* **45**: 54(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19802 **Removal of radioactive cobalt from highly saline streams.** Barkatt, A.; Macedo, P.B.; Penafiel, L.M.; Sousanpour, W. (Catholic University of America, Vitreous State Laboratory, Washington, DC 20064). *Transactions of the American Nuclear Society;* **45**: 160-162(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19803 **Virtification of high-activity TMI Zeolite.** Bryan, G.H.; Knox, C.A.; Siemens, D.H. (Battelle-Pacific Northwest Lab., P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **45**: 130-131(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19804 **Testing a glass-based ion exchange at the Surry reactor.** Hagen, W.; Macedo, P.G.; Simmons, J.; Sutter, H.G. (Virginia Electric Power Company, Surry Power Station, P.O. Box 315, Surry, VA 23883). *Transactions of the American Nuclear Society;* **45**: 113(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19805 **State technical review of Waste Isolation Pilot Plant project.** Channell, J.K.; Neill, R.H. (State of New Mexico Environmental Evaluation Group, P.O. Box 968, Santa Fe, NM 87503). *Transactions of the American Nuclear Society;* **45**: 169-170(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19806 **A new waste form for ion-exchangers.** Sutter, H.G.; Macedo, P.B.; Simmons, C.J. (NPS Waste Technologies, Inc., 11309 Frederick Avenue, Beltsville, MD 20705). *Transactions of the American Nuclear Society;* **45**: 160(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19807 **Basalt glass ceramics for the immobilization of transuranic nuclear waste.** Chick, L.A.; Lokken, R.O.; Thomas, L.E. (Battelle, Pacific Northwest Lab., Richland, WA 99352). *American Ceramic Society Bulletin;* **62**: No. 4, 505-516(Apr 1983).

Transuranium (TRU) contaminated radioactive waste may be stored in the basalt deposits of the Hanford site in Washington state. A basalt-based TRU waste form has been developed to react with less dissolution and transport of radionuclides to the surrounding rocks. Testing and processing of this waste form are detailed. The basalt waste forms exhibit low leach rates. They also appear to be relatively insensitive to processing parameters (time and temperature) and to waste loading. Basalt-based waste forms are therefore promising materials for nuclear waste immobilization.

19808 **Site characterization of joint permeability using the heated block test.** Voegele, M.; Hardin, E.; Lingle, D.; Board, M.; Barton, N. (Terra Tek, Inc., Salt Lake City, Utah). pp 126-133 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—).

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

In the isolation of nuclear wastes in underground repositories joints are an important possible conduit for migration of wastes. Results of experiments to determine the effects of temperature and load pressure on the permeability of joints are reported. The experiments consisted of heated block tests in gneiss performed in an experimental mine in Idaho.

19809 **Preliminary results from the full-scale heater tests at the near-surface test facility.** Gregory, E.C.; Kim, K. (Rockwell Hanford Operations, Richland, WA). pp 143-148 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—).

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

The Basalt Waste Isolation Project (BWIP), as part of the National Waste Terminal Storage (NWTS) program, U.S. Department of Energy (DOE), has been conducting the Full-Scale Heater Tests to enhance the understanding of the behavior of a rock mass subjected to the thermal loading expected on emplacement of radioactive nuclear waste deep underground. The Full-Scale Heater Tests were initiated on July 1, 1980 and are scheduled to continue until June 1982. These tests are being conducted at the Near-Surface Test Facility (NSTF) which was designed as a multipurpose field test facility to investigate the feasibility of constructing a permanent waste repository in the Columbia River basalt. The NSTF is located in Gable Mountain on the Hanford Site in south-central Washington. This location was chosen because of its easy access to the Pomona basalt which has similar characteristics to the Umtanum flow found at approximately 1000 meters depth and considered a potential candidate for repository siting. Comprehensive field investigations are being carried out at the NSTF in the areas of site characterization and the determination of rock mass properties. These studies were designed to provide information required for development of predictive modeling techniques and to form a data base necessary for repository design and construction.

19810 **Example of fracture characterization in granitic rock.** Thorpe, R.K. (Lawrence Livermore National Lab., Berkeley, CA). pp 497-502 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—). Contract W-7405-ENG-48.

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

The Stripa mine, located in southcentral Sweden, is an inactive iron mine which incorporates a massive, medium-grained quartz monzonite pluton within its workings. The experimental site is at a depth of 338 m in the pluton and approximately 150 m from the contract with the synclinal ore body. As part of an integrated

program of rock mass characterization, the work described here pertains to a specific heater test, termed the "time-scaled" experiment, designed to investigate long-term thermal effects. A rock volume of roughly 6 x 30 x 15 m^3 is involved, containing an array of eight 1-kw electrical heaters. The heaters simulate radioactive waste canisters scaled by a factor of 0.32, which according to laws of similitude and heat conduction allows a ten-fold compression of the time scale. The heater test was concluded in late 1979, and the data reported here are being incorporated into analyses and models of the experiment.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 19741, 19754, 19756, 19757, 19768, 19769, 19770, 19793, 19801, 20731

19811 **(ANL—83-84) Influence of dissolved organic substances in groundwater on sorption behavior of americium and neptunium.** Boggs, S. Jr.; Seitz, M.G. (Argonne National Lab., IL (USA)). Jan 1984. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009114.

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Groundwaters typically contain dissolved organic carbon consisting largely of high molecular weight compounds of humic and fulvic acids. To evaluate whether these dissolved organic substances can enhance the tranport of radionuclides through the groundwater system, experiments were conducted to examine the sorption of americium and neptunium onto crushed basalt in the presence of dissolved humic- and fulvic-acid organic carbon introduced into synthetic groundwater. The partitioning experiments with synthetic groundwater show that increasing the concentration of either humic or fulvic acid in the water has a significant inhibiting effect on sorption of both americium and neptunium. At 22°C, adsorption of these radionuclides, as measured by distribution ratios (the ratio of nuclide sorbed onto the solid to nuclide in solution at the end of the experiment), decreased by 25% to 50% by addition of as little as 1 mg/L dissolved organic carbon and by one to two orders of magnitude by addition of 100 to 200 mg/L dissolved organic carbon. Distribution ratios measured in solutions reacted at 90°C similarly decreased with the addition of dissolved organic carbon but generally ranged from one to two orders of magnitude higher than those determined in the 22°C experiment. These results suggest that organic carbon dissolved in deep groundwaters may significantly enhance the mobility of radionuclides of americium and neptunium. 23 references, 5 figures, 11 tables.

19812 (CONF-8308106—, pp 349-358) **De minimis waste impacts analysis methodology.** Oztunali, O.I. (Dames and Moore, White Plains, NY); Roles, G.W. 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

A calculational methodology is being developed which can be used to estimate impacts from disposal of radioactive waste by less restrictive means (de minimis waste disposal). The methodology consists of two computer codes: one which determines annual radiological impacts to individuals and to populations from release of de minimis waste into less restrictive disposal pathways, and another which determines limiting concentrations of radionuclides based upon comparison with a set of individual dose limitation criteria. Operational impacts are calculated for de minimis waste transportation, treatment by incineration, and disposal. Long-term impacts after disposal (e.g., groundwater migration) are also calculated as are possible impacts from recycle of metal or glass. Alternatives for waste treatment/disposal include onsite, offsite as a municipal waste, and offsite as a hazardous waste. 5 references, 2 figures.

19813 (CONF-8308106—, pp 542-547) **Ground-water transport model selection and evaluation guidelines.** Simmons, C.S.; Cole, C.R. (Pacific Northwest Lab., Richland, WA). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Guidelines are being developed to assist potential users with selecting appropriate computer codes for ground-water contaminant transport modeling. The guidelines are meant to assist managers with selecting appropriate predictive models for evaluating either arid or humid low-level radioactive waste burial sites. Evaluation test cases in the form of analytical solutions to fundamental equations and experimental data sets have been identified and recommended to ensure adequate code selection, based on accurate simulation of relevant physical processes. The recommended evaluation procedures will consider certain technical issues related to the present limitations in transport modeling capabilities. A code-selection plan will depend on identifying problem objectives, determining the extent of collectible site-specific data, and developing a site-specific conceptual model for the involved hydrology. Code selection will be predicated on steps for developing an appropriate systems model. This paper will review the progress in developing those guidelines. 12 references.

19814 (CONF-8308106—, pp 591-608) **Preliminary results of a study to develop prediction parameters for radionuclide retention at future low-level waste disposal sites.** Neiheisel, J. (Environmental Protection Agency, Washington, DC). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Three low-level radioactive waste sites situated within three of the major surficial deposits of the United States are being investigated to determine predictive parameters that may exist for assessing the radionuclide retention at future LLW sites. Each of the major surficial deposits have a unique assemblage of sorptive minerals, texture, and chemical environmental factors that affect the sorption mechanism of the radionuclides. Preliminary results reveal predictive linear relationships for cesium and strontium in a plot of the percent sorptive minerals versus the sorption coefficient (Kd). The percent sorptive minerals are determined by a quantitative mineral method. Other radionuclides reflect retention related to mineralogy but with other sorption mechanism (pH, Eh, presence of organics, ligands, or oxyhydroxides) principal governing factors. 15 references, 5 figures, 4 tables.

19815 (CONF-8308106—, pp 609-649) **Chemical characteristics, migration and fate of radionuclides at commercial shallow land burial sites.** Kirby, L.J.; Toste, A.P. (Pacific Northwest Lab., Richland, WA). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

An experimental trench and inert atmosphere wells installed at the Maxey Flats, Kentucky, shallow-land burial site permit sampling to determine the actual chemical species of radionuclides that migrate by subsurface routes. Water samples from several inert atmosphere wells and waste-filled trenches have been fractionated by steric exclusion chromatography and analyzed for their radionuclide and organic contents and complex species. Ethylenediaminetetraacetic acid (EDTA) is the major organic compound (about one part per million) in waste trench leachate and one inert atmosphere well. Other hydrophilic organic compounds, including carboxylic acids, are also present at parts-per-billion (ppB) levels. Plutonium co-elutes with EDTA, in agreement with earlier determinations that plutonium is present in subsurface water on site as a reduced, highly complexed anionic species. Cesium-137 and ^{90}Sr co-elute with a variety of organic acids and other hydrophilic compounds. Hydrophobic organic compounds were also measured at ppB levels, particularly in waste trench leachates. Non-radioactive tracer, radionuclide and organic compound measurements confirm that the subsurface flow patterns near the experimental area are extremely complex and have been influenced in the past by pumping activities while the evaporator was operating. 7 references, 9 figures, 13 tables.

19816 (CONF-8308106—, pp 693-710) **Effects of macropores on groundwater flow and transport of radionuclides.** Huff, D.D.; DeAngelis, D.L.; Yeh, G.T. (Oak Ridge National Lab., TN). 1983. NTIS, PC A99/MF A01. Contract W-7405-ENG-26.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

In humid environments, recent findings have shown that an important component of runoff and associated solute moves rapidly through large continuous voids. Thus, consideration of radionuclide transport in subsurface flow is incomplete without explicit treatment of continuous macropores and interaction between macropore flow and the soil matrix. A computer model, FRACPORT, that simulates the transport of a solute through a fractured porous matrix has been developed. The model employs the Integrated Compartment Method and uses the approach of dividing the porous media into compartments comprising fractures or porous material. The fracture region and a small portion of the porous matrix are simulated using a shorter time step than for the remaining porous matrix. This allows substantial savings in computational time. The model should be useful for analyses of generic problems associated with water and radionuclide transport in macropore systems at shallow-land disposal sites in humid environments. 14 references, 6 figures, 1 table.

19817 (CONF-8308106—, pp 737-761) **Mobility of organic complexes of radionuclides in soils.** Swanson, J.L. (Pacific Northwest Lab., Richland, WA). 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Results are presented to illustrate the importance of another important aspect of kinetically-inert complexes of Ni and Co to radionuclide migration; such complexes can be sorbed by some soils, while only the uncomplexed species are sorbed by others. As shown earlier, when only uncomplexed species are sorbed the kinetic inertness of the complexes can prevent significant sorption of the radionuclides by soil. Other data provide added evidence that the importance of kinetically-inert complexes varies greatly among complexants, as well as among soils. 6 references, 8 figures.

19818 **(EUR—8251) Differential radiological impact of plutonium recycle in fuel cycle of light-water reactors: released effluents in normal operation.** Bouville, A.; Guetat, P.; Jones, J.A.; Kelly, G.N.; Le Grand, J.; White, I.F. (Commission of the European Communities, Luxembourg). 1982. 184p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84700761.

The radiological impact of fuel cycle of light-water reactors using enriched uranium fuel can be modified by plutonium recycle. The differences, that result, can happen in the different stages of fuel cycle; this study gives an evaluation of the differences resulting from radioactive effluents released in normal operation for the different facilities. The differential radiological impact on the population of the European Community is evaluated for the recycle of 10t of fissile metal plutonium. The evaluation is carried out for every stage of fuel cycle. The atmospheric and liquid effluents are separately processed; a large characteristics scale of the environmental receiving effluents, representative of those met in the European Community, is taken into account for the evaluation of radiological impact. Plutonium recycle involves a reduction of radiological impact resulting from released effluents in normal operation about 30% compared to enriched uranium fuel cycle.

19819 **(NUREG—1049) Environmental Impact Appraisal for renewal of special nuclear material license No. SNM-42 (Docket No. 70-27).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Mar 1984. 89p. NTIS, PC A05/MF A01 - GPO* $4.50. Order Number DE84900893.

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The Babcock and Wilcox Company (B and W) Naval Nuclear Fuel Division (NNFD) facility near Lynchburg, Virginia, produces fuel assemblies and complete fuel modules for reactors used in the US Navy nuclear propulsion program and fuel components for university and other research reactors; and processes scrap material to recover the enriched uranium content. No significant modifications of the production procedures for the US Navy nuclear fuel fabrication have been made since the previous environmental assessment, and none are anticipated during the five-year license renewal period being considered. In 1982 the fabrication of fuel assemblies for university and other research reactors was begun. This environmental assessment provides a review of the past five years of operation and an analysis of future impacts, including the effect of plant changes. The proposed action is the renewal of the license necessary for B and W to continue the existing fuel fabrication operations. Principal operations in the fabrication facility include the processing of highly enriched uranium (> 90% ^{235}U) into fuel elements and assembling the elements into complete reactor cores for shipment and eventual installation in US Navy facilities. The principal environmental impacts of current operation of the NNFD result from release of radioactive gases to the atmosphere and of radioactively contaminated liquids to the adjacent James River. The actual gaseous and liquid pollutants released during normal operation of the plant have been monitored and documented. The principal subjects addressed in this environmental assessment include water use, pollutant controls, environmental monitoring, and environmental impact of operation and accidents. Other site factors and plant operations necessary for this assessment are described, and aspects of insignificant impacts are identified. 10 figures, 36 tables.

19820 **(NUREG/CR—3104) Aquifer restoration techniques for in-situ leach uranium mines.** Deutsch, W.J.; Bell, N.E.; Mercer, B.W.; Serne, R.J.; Shade, J.W.; Tweeton, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-65RL01830. 55p. (PNL—4583). NTIS, PC A04/MF A01 - GPO $4.50; GPO Dep. Order Number DE84009219.

In-situ leach uranium mines and pilot-scale test facilities are currently operating in the states of Wyoming, Texas, New Mexico and Colorado. This report summarizes the technical considerations involved in restoring a leached ore zone and its aquifer to the required level. Background information is provided on the geology and geochemistry of mineralized roll-front deposits and on the leaching techniques used to extract the uranium. 13 references, 13 figures, 4 tables.

19821 **(NUREG/CR—3389) Valence effects on the sorption of nuclides on rocks and minerals.** Meyer, R.E.; Arnold, W.D.; Case, F.I. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 48p. (ORNL—5978). NTIS, PC A03/MF A01 - GPO; GPO Dep. Order Number DE84007581.

Estimation of the rates of migration of nuclides from nuclear waste repositories requires knowledge of the interaction of these nuclides with the components of the geological formations in the path of the migration. These interactions will be dependent upon the valence state and speciation of the nuclide. Experiments designed to measure interaction of multivalent nuclides and minerals must therefore include some form of valence state control. An electrochemical method of valence state control was developed which makes use of a porous electrode in a flow system containing a column of the adsorbent. By use of this method and solvent extraction analyses of the valence states, a number of reactions of interest to HLW repositories were investigated. These include the reduction of Np(V) and Tc(VII) by crushed basalt and other minerals. For the reduction of Np(V) by basalt, the experiments indicate that the sorption of basalt increases with pH and that most of the Np is reduced to Np(IV) which is very difficult to remove from the basalt even if oxygenated tracer-free solution is added to the solution. For the experiments with Tc(VII), the results are considerably more complicated. The results of these experiments are used to assess some of the techniques and methods currently used in safety analyses of proposed HLW repositories. 10 figures, 7 tables.

19822 **(NUREG/CR—3560) Evaluation methods for the consequences of below water table mine disposal of uranium mill tailings.** McKeon, T.J.; Nelson, R.W. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-65RL01830. 82p. (PNL—4904). NTIS, PC E05/MF A01 - GPO $5.50; GPO Dep. Order Number DE84009218.

Includes 1 sheet of 24x reduction microfiche.

A method has been developed at the Pacific Northwest Laboratory to evaluate the environmental consequences of below water table disposal of uranium mill tailings in mine stopes. The method described uses analytical expressions for the velocity potential and examines the convective transport of tailings liquor and leachate through the aquifer and into a water supply well located downgradient from the mine stope. The arrival distribution of contaminant (mass flux versus time) and the concentration pumped from the well as a function of time are the final results of the analysis. 8 references, 21 figures.

19823 **(ORNL/TM—8991) Determination of the areal distribution of ^{90}Sr in groundwater via single-use boreholes.** Spalding, B.P.; Munro, I.L. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract AC05-84OR21400. 46p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009468.

Shallow groundwater samples were collected at 3- to 5-m intervals along the perimeters of the southern and eastern boundaries of solid waste storage areas (SWSAs) 4 and 5 at ORNL. Samples were taken by way of single-use boreholes established with a foot-operated soil corer. This detailed perimeter survey should facilitate the optimal placement of permanent monitoring wells on the SWSA perimeters. Samples were analyzed for hardness, electrical conductivity, pH, and ^{90}Sr. The determination of ^{90}Sr was routinely performed by the detection of Cerenkov radiation and showed an excellent correlation ($r^2 = 0.996$, $n = 42$) with the standard radiochemical procedure. A major peak of ^{90}Sr ground contamination (1 to 4 kBq/L) was observed along a 100-m reach of the SWSA 4 perimeter in the south central region. Three peaks of ^{90}Sr contamination were detected along the perimeter of SWSA 5. Intermittent sampling over three years of a permanent monitoring well (5 to 428) in SWSA 5 indicated that ^{90}Sr concentrations fluctuated from 1.2 to 20 kBq/L and were correlated with groundwater hardness. Groundwaters of both SWSAs were shown to be of a $Ca(HCO_3)_2$ type; SWSA 4 groundwaters tended to be slightly supersaturated and SWSA 5 groundwaters slightly undersaturated with respect to $CaCO_3$. The primary tributary draining the central region of SWSA 5 exhibited an average ^{90}Sr concentration of 72 Bq/L under low-flow conditions, whereas a smaller tributary, originating from a groundwater seep on the southwestern perimeter, exhibited an average ^{90}Sr concentration of 7.7 kBq/L. 23 references, 23 figures, 6 tables.

19824 **(PERG-RR—9) Environmental impact of a projected uranium development in Co. Donegal, Ireland.** (Political Ecology Research Group, Oxford (UK)). [nd]. 167p. British Library Lending Division, Boston Spa, Wetherby, West Yorks., LS23 7BQ.

The report assesses both the generic and the site specific aspects of the projected uranium developments in Co. Donegal. The main focus is upon the health and safety issues arising from the dispersion of radioactivity in the vicinity of the project and the long term implications of waste disposal. The socio-economic aspects are also reviewed, in particular the likely balance of advantages and disadvantages with regard to employment in the region. The impact on the natural resources of the region is assessed. The effects of a single small operation and of regional development of mining and milling are compared. The radiological hazards of mine tailings require careful control, particularly in siting. A major review of the Low Level Radiation controversy is presented. A review of the international system for regulating radiation protection concludes that national authorities should take a greater role in the assessment of acceptable risks and that the ICRP recommendations and EEC directives should not be seen as an effective substitute. Finally, the report provides an extensive bibliography and overview of mitigation technology and monitoring programmes, and should prove of use as a guide for further analysis by the local authorities.

0540 Health And Safety

REFER ALSO TO CITATION(S) 19724, 19733, 19735, 19736, 19759, 19762, 19778, 19794, 19812, 19823

19825 **(AERE-R—10774) Resistance of some inorganic surfaces to the retention of α-active powders.** Dalton, J.T.; Wilkins, R.I. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jun 1983. 14p. HMSO, London price $2.00.

The ease with which particles of UO_2 or PuO_2 can be removed from inorganic surfaces by washing, has been tested as a function of surface finish on materials commonly used in glove boxes. Surface damaging processes, analogous to normal glove box operations, which cause hard particles of UO_2 or PuO_2 to become embedded in the flawed surface of abraded metals have been developed. Under wear conditions it has been shown that resistance to contamination by α-emitting powders depends largely on the hardness of the material's surface.

19826 (CONF-8308106—, pp 529-541) **Use of PRESTO-EPA model in assessing health effects from land disposal of LLW to support EPA's environmental standards.** Hung, C.Y. (Environmental Protection Agency, Washington, DC); Meyer, G.L.; Rogers, V.C. 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The PRESTO-EPA Model will be used by EPA to estimate the potential health effects from the land disposal of low-level radioactive wastes (LLW), to support EPA's LLW standards. The model is applicable to a number of shallow land disposal methods and is currently being modified to extend its applicability to deep land disposal methods as well. EPA will be conducting extensive cost-benefit analyses to support the levels chosen for the LLW standards. As PRESTO-EPA is currently designed, many hundreds of runs would be required for the health-risk portion of these analyses. Therefore, EPA has developed a more efficient approach, the unit response method to EPA's health-risk assessments. 12 references, 2 figures, 3 tables.

19827 **(DP-MS—84-16) Application of probabilistic risk assessment to reprocessing.** Perkins, W.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 10p. (CONF-840257—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009078.

From DOE nuclear reactor and facility safety conference; Rockville, MD, USA (27 Feb 1984).

The Savannah River Laboratory uses probabilistic methods of risk assessment in safety analyses of reprocessing facilities at the Savannah River Plant. This method uses both the probability of an accident and its consequence to calculate the risks from radiological, chemical, and industrial hazards. The three principal steps in such an assesment are identification of accidents, calculation of frequencies, and consequence quantification. The tools used at SRL include several databanks, logic tree methods, and computer-assisted methods for calculating both frequencies and consequences. 5 figures.

19828 **(K/CSD/TM—55) Radiation levels in a gaseous diffusion plant assuming a low-enriched criticality event corresponding to the ANSI-standard minimum accident of concern.** Westfall, R.M.; Knight, J.R. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Feb 1984. Contract W-7405-ENG-26. 50p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007681.

The two-dimensional DOT-IV discrete-ordinates program was applied in analyses of the K-33 cell floor radiation levels due to four hypothetical criticality events. The radiation sources correspond to leakage spectra from critical uranyl fluoride solutions ranging from 1.2 to 4.95 weight percent enrichment. For the criticality-alarm-system ANSI Standard 8.3 minimum accident of concern (1200 Rad/hour at 2 meters from the surface of the critical volume), the dose rates at the maximum source-detector distance

vary from approximately 150 to 200 mRad/hour of either neutron or photon radiation. The report includes a discussion of the methodology employed in the study, biological dose rates, thermal neutron reaction rates and appended dose rate plots. 10 references, 15 figures, 7 tables.

19829 **(SAND—80-7155) Sociocultural analysis for the proposed Waste Isolation Pilot Plant.** Albrecht, S.; Chadwick, B.; Nowak, S.; Adcock, L. (Adcock (Larry) and Associates, Albuquerque, NM (USA)). Nov 1980. Contract AC04-76DP00789. 71p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84010078.

In order to assess the potential or perceived sociocultural impact due to the construction and operation of the proposed Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico, a discussion-type survey was conducted in August and September of 1979. During those two months four researchers conducted probing-type discussions with nearly 200 Carlsbad area residents. The results of those discussions were analyzed for inclusion in the WIPP Final Environmental Impact Statement. The impacts on sociocultural aspects perceived by the residents included both positive and negative impacts. The most frequently mentioned positive impacts were new jobs, increased activity in business sectors and the housing industry, and new residents to the area. Negative impacts included perceived inflation or price increases, strained services and community infrastructure, attraction of transient construction workers, safety and health risks, and unequal distribution of benefits and costs. 2 tables.

19830 **Techniques for yellowcake dissolution studies in vitro and their use in bioassay interpretation.** Eidson, A.F.; Griffith, W.C. Jr. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *Health Physics;* **46**: No. 1, 151-163(Jan 1984). Contract AC04-76EV01013.

The high variability in solubility of yellowcake produced by different mills complicates the interpretation of routine bioassay data. A simple in vitro dissolution test is needed for yellowcake to improve this interpretation. A series of experiments was designed to evaluate the relative importance of solvent composition, method, pH and temperature in determining yellowcake dissolution according to a model developed from the known composition of a test yellowcake and data from inhalation exposures of humans to UO_3 or U_3O_8. Useful in vitro dissolution results can be obtained using either simulated serum ultrafiltrate or simulated lung fluid as the solvent if dissolved and undissolved yellowcake are separated by a membrane filter. In vitro dissolution experiments estimated the soluble portion of the test yellowcake within +/-6% (mean +/-2S.E.) and showed that the dissolution rates of the more soluble and less soluble portions corresponded to Class D and Class Y compounds, respectively. It was not necessary to maintain physiological pH or temperature conditions to approximate the "human" model. The greatest utility of in vitro dissolution results was in the estimation of the more soluble fraction of the yellowcake and to indicate whether prior excretion of a Class D uranium compound and possible kidney damage could have occurred before detection of an exposure. Some guidelines for the use of in vitro dissolution data in bioassay interpretation are suggested based in ICRP Publication 30 recommendations.

0550 Regulations

REFER ALSO TO CITATION(S) 19746

19831 **(CONF-8405119—1) Physical protection system using activated barriers.** Timm, R.E.; Zinneman, T.E.; Haumann, J.R.; Flaugher, H.A.; Reigle, D.L. (Argonne National Lab., IL (USA)). Mar 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007303.

From Carnahan conference on security technology; Lexington, KY, USA (16 May 1984).

The Argonne National Laboratory has recently installed an activated barrier, the Access Denial System, to upgrade its security. The technology of this system was developed in the late 70's by Sandia National Laboratory-Albuquerque. The Argonne National Laboratory is the first Department of Energy facility to use this device. Recent advancements in electronic components provide the total system support that makes the use of an activated barrier viable and desirable. The premise of an activated barrier is that it is deployed after a positive detection of an adversary is made and before the adversary can penetrate vital area. To accomplish this detection, sophisticated alarms, assessment, and communications must be integrated into a system that permits a security inspector to make a positive evaluation and to activate the barrier. The alarm sensor locations are selected to provide protection in depth. Closed circuit television is used with components that permit multiple video frames to be stored for automated, priority-based playback to the security inspector. Further, algorithms permit look-ahead surveillance of vital areas so that the security inspector can activate the access denial system in a timely manner and not be restricted to following the adversaries' penetration path(s).

19832 **(NUREG—0525-Rev.8) Safeguards Summary Event List (SSEL).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Mar 1984. 61p. NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84901012.

The Safeguards Summary Event List (SSEL) provides brief summaries of several hundred safeguards-related events involving nuclear material or facilities regulated by the U.S. Nuclear Regulatory Commission (NRC). Events are described under the categories of bomb-related, intrusion, missing and/or allegedly stolen, transportation, tampering/vandalism, arson, firearms, radiological sabotage and miscellaneous. The information contained in the event descriptions is derived primarily from official NRC reporting channels.

19833 **(Y/DW—441) Off-line nondestructive analysis at a uranium recovery facility.** Hogue, H.H.; Smith, S.E. (Oak Ridge Y-12 Plant, TN (USA)). 10 Jan 1984. Contract W-7405-ENG-26. 11p. (CONF-831106—24). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007684.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

A nondestructive assay laboratory is in operation at the Oak Ridge Y-12 Plant in a facility for recovery of highly enriched uranium from manufacturing wastes. The laboratory contains instruments for gamma scanning and neutron interrogation of containers of solid wastes, gamma analysis of solution samples, and measurements of solution density. This facility has replaced sampling and chemical analysis or simple gamma counting for uranium inventory measurements on five material types. The benefits are increased speed, improved accuracy, and lowered costs for obtaining uranium inventories. 4 figures, 4 tables.

19834 **A portable load-cell-based system for weighing UF_6 cylinders.** Fainberg, A.; Mitchell, R. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society, Supplement;* **45**: 6-7(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19835 **Spent fuel verification by ultraviolet Cherenkov emission.** Nakaoka, A.; Fukushima, M.; Kuribara, M.; Tamaoka, K. (Central Research Institute of Electric Power Industry 11-1, Iwato Kita 2-chome Komae-shi Tokyo 201). *Transactions of the American Nuclear Society, Supplement;* **45**: 7(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19836 **The process: International safeguards interface at the Portsmouth GCEP.** Tape, J.W.; Baker, A.L.; Strittmatter, R.B. (Los Alamos National Laboratory, Los Alamos, NM 87545). *Transactions of the American Nuclear Society, Supplement;* **45**: 8(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19837 **Development of an enrichment monitor for the Portsmouth GCEP.** Strittmatter, R.B.; Sprinkle, J.K.; Stovall, L.A. (Los Alamos National Laboratory, Los Alamos, NM 87545). *Transactions of the American Nuclear Society, Supplement;* **45**: 8-9(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19838 **Gas-phase sampling of UF_6 cylinders in international safeguards.** Cardwell, R.G.; Sindle, D.W.; Younkin, J.M. (Oak Ridge Gas Diffusion Plant, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society, Supplement;* **45**: 9-10(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19839 **Measurements of uranium holdup in an operating gaseous diffusion enrichment plant.** Auguston, R.H.; B Harbarger, W.; Fields, L.; Harris, R.; Hicks, J.; Jones, S.; Shissler, D.; Tayloe, R.; Timmons, G.; Walton, R.B. (Los Alamos National Laboratory, Los Alamos, NM 87545). *Transactions of the American Nuclear Society, Supplement;* **45**: 10(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19840 **Assessment of bulk measurements in the nuclear fuel cycle.** Whetstone, J. (National Bureau of Standards, Washington, DC 20234). *Transactions of the American Nuclear Society, Supplement;* **45**: 11(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19841 **Development of improved cell buret at the Savannah River plant.** Gelsie, M. (E.I. du Pont de Nemours & Co., Savannah River Plant, Aiken, SC 29808). *Transactions of the American Nuclear Society, Supplement;* **45**: 2-4(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19842 **An automated program for the acquisition of tank calibration data.** Liebetrau, A.M. (Rockwell Hanford Operations, P.O. Box 800, Richland, WA 99352). *Transactions of the American Nuclear Society, Supplement;* **45**: 13(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19843 **Implementation of nondestructive assay instrumentation in the Rocky Flats processing facility.** Haas, F.X.; Gilmer, J.E.; Goebel, G.R.; Lawless, J.L.; Pigg, J.L.; Scott, D.L.; Tindall, A.L. (Rockwell International Energy Systems Group, Rocky Flats Plant, P.O. Box 464, Golden, CO 80401). *Transactions of the American Nuclear Society, Supplement;* **45**: 13-14(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19844 **Operation of automated NDA instruments for in-line HEU accounting at Y-12.** Russo, P.A.; Bowers, G.L.; Jeter, I.W.; McCullough, E.; Sandford, E.L.; Strittmatter, R.B. (Los Alamos National Laboratory, Los Alamos, NM 87545). *Transactions of the American Nuclear Society, Supplement;* **45**: 14-15(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

19845 **Implementation of new analytical measurement techniques within an operating process environment.** Filby, E.E.; Emel, W.A. (Exxon Nuclear Idaho Company, P.O. Box 2800, Idaho Falls, ID 83401). *Transactions of the American Nuclear Society, Supplement;* **45**: 15-16(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

06 FUSION FUELS

0605 Health And Safety

REFER ALSO TO CITATION(S) 19846

0607 Waste Management

19846 **Potential low-level waste disposal limits for fusion radionuclides.** Kennedy, W.E.; Mann, F.M. (Westinghouse Hanford Company, P.O. Box 1970, Richland, WA 99352). *Transactions of the American Nuclear Society;* **45**: 51-52(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

19847 **(UCRL—89824) Novel, convenient, and nonpersistent radiotracer for environmental and energy applications.** Grant, P.M. (Lawrence Livermore National Lab., CA (USA)). 12 Mar 1984. Contract W-7405-ENG-48. 9p. (CONF-840408—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009539.

From 5. international conference on nuclear methods in environmental and energy research; Mayaguez, Puerto Rico (2 Apr 1984).

A newly-available radioisotopic system, ^{172}Hf-^{172}Lu, has excellent potential for tracer applications in which nuclear data acquisition must be accomplished in real time. The 6.7-day half-life of ^{172}Lu is sufficient for a large fraction of tracer experiments, and should allow the direct incorporation of ^{172}Lu into tests that have traditionally utilized much longer-lived radionuclides. Since ^{172}Lu is the daughter component of a radioisotope generator, however, its effective shelf-life is determined by the half-life of its 1.9-year ^{172}Hf parent. Consequently, the frequency of isotope procurement need not be any more extensive than investigators would normally be accustomed to. Discussion relevant to isotope production, generator operation, and nuclide acquisition is presented in this paper.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 20524, 20595

19848 (UTNL-R—0110, pp 104-106) **^{85}Kr handling experiences.** Otsuka, Norikatsu (Kyushu Tokai Univ., Kumamoto (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01.

In Summaries of environmental safety in nuclear fuel cycles; fiscal 1979 and 1980.

The research on ^{85}Kr was carried out for 16 years until March, 1980, at Takasaki Research Establishment, Japan Atomic Energy Research Institute. The works done were extensive from the measurements of radioactivity and radiation dose to recovery, refining, concentration, storage and utilization, and broadly two areas of the development of utilization of ^{85}Kr radiation sources and the environmental safety with ^{85}Kr were taken up. Concerning the ^{85}Kr handling experiences there, the following matters are described: the apparatuses for ^{85}Kr liquid phase irradiation reaction, ^{85}Kr solid surface irradiation and ^{85}Kr concentration; the experiences and main results of the absolute measurement of ^{85}Kr radioactivity, the permissible leak rate of exhaust facilities, vacuum-system materials, shielding, decontamination, ^{85}Kr gas refining and isotope separation, etc.

19849 (ZfI-Mitt—69, pp 161-174) **Development of the nuclear-physical methods of analysis at the Laboratory of Nuclear Reactions of the JINR.** Belov, A.G.; Zhuchko, V.E.; Zamyatin, Yu.S.; Teterev, Yu.G.; Rubio, D. (Joint Inst. for Nuclear Research, Moscow (USSR). Lab. of Nuclear Reactions). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The possibility of using relatively simple intensive neutron and gamma sources for the purposes of activation analysis is demonstrated. In particular, microtron and antimony-beryllium photoneutron sources offer the possibilities of solving a wide range of problems in the elemental analysis of substances by gamma and neutron activation analysis.

19850 (ZfI-Mitt—69, pp 55-70) **Measurement of residence time distribution with radiotracers using periodic pseudo-random binary signal sequences.** Richter, M. Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A review about the properties of several types of tracer-input signals is given and in particular the stochastic signals are discussed. The use of periodic pseudo-random binary signals (PRBS) permits a strong reduction of the measuring time. The PRBS method has special advantages in comparison with impulse methods, if fluctuations and disturbances exist within the investigated systems. Correlations for the estimation of parameters, needed for the realization of PRBS measurements, are given and several measuring arrangements are discussed. The application of the PRBS method for measurements of residence time distribution of a mixer-settler extractor is described using /sup 99m/Tc as tracer.

19851 (ZfI-Mitt—69, pp 89-94) **Measurements of air currents.** Bohne, H. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A differential method for investigating the ventilation within rooms by means of a radioactive indicator is described. The result is presented as a unit of an instrument set and a mathematical model.

19852 (ZfI-Mitt—69, pp 95-106) **Tracer study of simultaneous homogenization and segregation in industrial equipment.** Baranyai, L. (Magyar Tudomanyos Akademia, Budapest. Izotopintezete). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Homogenization investigations were carried out on laboratory-scale homogenizer operating by air blown in for determining the character of the homogenization process and its time function using ^{65}Zn-labelled plastic ion exchanger. Besides this, investigations on industrial homogenizers for determining the optimal operation parameters were also performed employing ^{198}Au-labelled clay, pyrite or limestone in cement homogenization.

19853 (ZfI-Mitt—69, pp 107-113) **Application of radiotracer method for study of glass furnaces.** Balabanov, N.; Kapitanova, N. (Plovdivski Univ. (Bulgaria)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The operation of several glass furnaces has been investigated by means of radiotracers. These investigations enable us to define some general parameters of glass movement and its behaviour in different zones of the furnaces. The information obtained about the furnace output is discussed in terms of a diffusion model. The diffusion model renders it possible to evaluate some technological parameters: the mean residence time of the material in the furnace, the efficient volume of the furnace, Peclet number, etc.

19854 (ZfI-Mitt—69, pp 151-160) **Investigation of the mixing efficiency of kneading machines using radionuclides.** Koennecke, H.G.; Kulicke, P.; Antal, E. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Jentzsch, J.; Michael, H. (Technische Hochschule, Karl-Marx-Stadt (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The effective mixing time in a kneader was determined as a function of the speed of the kneader up to 100 r.p.m. In the range from 40 to 100 r.p.m. the effective mixing time required to reach the state of homogeneity is nearby constant. In the system caoutchouc/filler/mould lubricant the filler was labelled with /sup 99m/Tc. The measuring equipment consisting of a scintillation detector, a rate meter and a continuous recorder is described.

19855 (ZfI-Mitt—69, pp 442-459) **Axial dispersion and homogenization in chemical engineering systems.** Merz, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Isotopentechnik). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The knowledge of process dynamics is an essential prerequisite for the optimization of apparatuses and methods in chemical industry. The application of radiotracer methods defining the intensity of axial mixing and homogenization effect is demonstrated by means of three selected examples of technical systems: maize powder mixing, waste water treatment, and chemical process in a rotary kiln of Rhenania-phosphate production using ^{24}Na as tracer.

19856 (ZfI-Mitt—69, pp 461-465) **Investigation of material transport in rotating dryers by aid of ^{140}La.** Zeuner, A.; Hartmann, F. (Technische Univ., Dresden (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

In order to optimize material transport investigation in hot reactors, especially in rotating drum dryers, a Ba-La radioisotope generator for medium activities was developed and practically applied. To correct the influence of material depositions at the dryer walls on the residence time distribution, a non-linear background change was assumed and used for correction the residence time curves. An equation is postulated for describing the material transport through the dryer. The coefficients of this equation are determined by the least square method. A further generalization of this transport equation is offered.

0703 Isotopic Power Supplies

19857 (DP-MS—83-85) Ir/PuO_2 compatibility: transfer of impurities from plutonium dioxide to iridium metal during high temperature aging. Taylor, D.H.; Christie, W.H.; Pavone, D. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Oak Ridge National Lab., TN (USA); Los Alamos National Lab., NM (USA)). 1984. Contract AC09-76SR00001. 25p. (CONF-840218—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008301.

From 113. annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers; Los Angeles, CA, USA (26 Feb 1984).

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Plutonium oxide fuel pellets for powering radioisotopic thermoelectric generators for NASA space vehicles are encapsulated in iridium which has been grain-boundary-stabilized with thorium and aluminum. After aging for 6 months at 1310°C under vacuum, enhanced grain growth is observed in the near-surface grains of the iridium next to the PuO_2. Examination of the grain boundaries by AES and SIMS shows a depletion of thorium and aluminum. Iron, chromium, and nickel from the fuel were found to diffuse into the iridium along the grain boundaries. Enhanced grain growth appears to result from thorium depletion in the grain boundaries of the near-surface grains next to the fuel. However, in one instance grain growth was slowed by the formation of thorium oxide by oxygen diffusing up the grain boundaries.

19858 (DPST—80-129-6) Pu-238 fuel form activities, June 1-30, 1980. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 18 Jul 1980. Contract AC09-76SR00001. 25p. NTIS, PC A02/MF A01. Order Number DE84009026.

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This monthly report for Pu-238 Fuel Form Activities has two main sections: SRP-PuFF Pu-238 Fuel Form Production Processes and SRL Pu-238 Fuel Form Research and Development. The program status, budget information, and milestone information are discussed in each main section. The Work Breakdown Structures (WBS) for this program is outlined. Only one monthly report per year is processed for EDB.

19859 (DPST—81-133-1) Pu-238 fuel form activities, January 1-31, 1981. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Feb 1981. Contract AC09-76SR00001. 29p. NTIS, PC A03/MF A01. Order Number DE84007711.

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This monthly report for ^{238}Pu Fuel Form Activities has two main sections: SRP-PuFF facility and SRL Fuel Form Activities. The program status, budget information, and milestone schedules are discussed in each main section. The Work Breakdown Structure (WBS) for this program is shown. Only one monthly report per year is processed for EDB.

19860 (DPST—82-133-1) Pu-238 fuel form activities, January 1-31, 1982. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Mar 1982. Contract AC09-76SR00001. 32p. NTIS, PC A03/MF A01. Order Number DE84009006.

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This monthly report for ^{238}Pu fuel form activities has two main sections: SRP-PuFF facility and SRL fuel form activities. The program status, budget information, and milestone schedules are discussed in each main section. The Work Breakdown Structure (WBS) for this program is shown. Only one monthly report per year is processed for EDB.

19861 (DPST—83-133-1) Pu-238 fuel form activities, January 1-31, 1983. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Mar 1983. Contract AC09-76SR00001. 20p. NTIS, PC A02/MF A01. Order Number DE84009004.

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This monthly report for ^{238}Pu Fuel Form Activities has two main sections: SRP-PuFF facility and SRL Fuel Form Activities. The program status, budget information, and milestone schedules are discussed in each main section. The Work Breakdown Structure (WBS) for this program is shown. Only one monthly report per year is processed for EDB.

19862 (TES—32066-1) SNAP 19 Viking Program. Bimonthly technical progress report, October 1979-November 1979. (Teledyne Energy Systems, Timonium, MD (USA)). Dec 1979. Contract AC01-80ET32066. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010252.

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Monitoring and evaluation of Viking 1 Lander power system data continued. The RTG series power range as measured at the PCDA was 65 to 68 watts at fin root temperatures between 280°F and 310°F. The Mars landed performance history of Viking 1 include both the minimum and maximum data for each of the SOL days. Monitoring and evaluation of Viking 2 Lander power system data continued. The RTG series power range as measured at the PCDA was 71 to 72 watts at fin root temperatures between 230°F and 260°F. The Mars landed performance history of Viking 2 include both the minimum and maximum data for each of the SOL days. The performance of both power systems continues to be very satisfactory. Power system performance data for Pioneer 10 and Pioneer 11 spacecraft were monitored through the reporting period. The estimated RTG system net power was 116 watts for Pioneer 10 and 118 watts for Pioneer Saturn. The September 1 encounter with Saturn appears to have had no deleterious effect on the RTG's of the spacecraft power system. The telemetry signals from both spacecrafts remain satisfactory.

19863 (TES—32066-2) SNAP 19 Viking Program. Bimonthly technical progress report, December 1979-January 1980. (Teledyne Energy Systems, Timonium, MD (USA)). 1980. Contract AC01-80ET32066. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010247.

Power system performance data for Pioneer 10 and Pioneer Saturn (initially designated Pioneer 11) were monitored through the reporting period. The estimated RTG system net power was 115 watts for Pioneer 10 and 116 watts for Pioneer Saturn. The telemetry signal quality from both spacecraft systems remains satisfactory.

19864 (TES—32066-3) SNAP 19 Viking Program. Bimonthly technical progress report, February 1980-March 1980. (Teledyne Energy Systems, Timonium, MD (USA)). 1980. Contract AC01-80ET32066. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010248.

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Viking 1 Lander power system data has not been available during this reporting period, but summary reports indicate no anomalies in performance. Monitoring and evaluation of Viking 2 Lander power system data continued. Temperature data were similar to those 23 months ago, but combined RTG output power was down by 7 watts from the 75 watts recorded in February of 1978. On February 7, 1980, during a scheduled relay transmission the Lander 2 battery voltage dropped below 26.5 volts. With the orbiter attitude control gas supply nearly depleted and the space network stations required for Voyager encounter with Saturn later this year, the final relay from Viking Lander 2 had been scheduled to take place on April 11. The attempt was made but no data were received. Power system performance data for Pioneer 10 and Pioneer Saturn (initially designated Pioneer 11) were monitored. The estimated RTG system net power was 115 watts for both, Pioneer 10 and Pioneer Saturn. The telemetry signal quality from Pioneer Saturn remains excellent. Pioneer 10, for the first time, shows a loss of signal strength.

19865 (TES—32066-4) SNAP 19 Viking Program. Bimonthly technical progress report, April-May 1980. (Teledyne Energy Systems, Timonium, MD (USA)). 1980. Contract AC01-80ET32066. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010249.

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Monitoring and evaluation of Viking Lander 1 power system data continued. The RTG series power range as measured at the PCDA was 65 to 67 watts at finroot temperatures between 280°F and 310°F. The Mars Lander performance history of Viking 1 include both the minimum and maximum data for each of the SOL days. Final available power system data for Viking Lander 2 are shown. Typical SOL day cycles for mission day 1193 are presented. The RTG series power ranged from 69 to 70 watts at finroot temperatures between 270°F and 300°F. The Mars Lander performance history for Viking 2 is shown. Power system performance data for Pioneer 10 and Pioneer Saturn (initially designated Pioneer 11) were monitored through the reporting period. After adjusting for the telemetry characteristics, the estimated RTG system net power was 114 watts for both Pioneer 10 and Pioneer Saturn.

19866 **(TES—32066-5) SNAP 19 Viking Program. Bimonthly technical progress report, June-July 1980.** (Teledyne Energy Systems, Timonium, MD (USA)). 1980. Contract AC01-80ET32066. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010245.

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Monitoring and evaluation of Viking Lander 1 power system data continued. The RTG series power range as measured at the PCDA was 64 to 66 watts at finroot temperatures between 270°F and 310°F. Figures show the Mars Lander performance history of Viking 1. These data include both the minimum and maximum data for each of the SOL days plotted to show the range of performance experienced on the Martian surface. Power system performance data for Pioneer 10 and Pioneer Saturn (initially designated Pioneer 11) were monitored through the reporting period and are shown. After adjusting for the telemetry characteristics, the estimated RTG system net power was 114 watts for both, Pioneer 10 and Pioneer Saturn.

19867 **(TES—32066-7) SNAP 19 Viking Program. Bimonthly technical progress report, October-November 1980.** (Teledyne Energy Systems, Timonium, MD (USA)). 18 Dec 1980. Contract AC01-80ET32066. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010246.

Monitoring of power system performance data for Pioneer 10 and Pioneer Saturn spacecrafts continued through the reporting period. The net power output for either system at the end of October 1980 was 113 watts. Pioneer 10 degradation has been nearly linear at a rate of 0.130 watts/1000 generator hours, while the Pioneer Saturn power degradation is slightly higher at 0.135 watts/1000 generator hours.

19868 **(TES—32066-8) SNAP 19 Viking Program. Bimonthly technical progress report, December 1980-January 1981.** (Teledyne Energy Systems, Timonium, MD (USA)). 11 Mar 1981. Contract AC01-80ET32066. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009456.

Monitoring of power systems performance data for Pioneer 10 and Pioneer Saturn spacecrafts continued. Net power output for either system during mid-January of 1981 was 112 watts. Power degradation has, for several years, been stable between 4 and 5 watts per year. Viking 1 Lander data acquisition has been resumed following the conclusion of Saturn encounter activities. Figures show the Mars Lander performance history of Viking 1. These data include both the minimum and maximum data for each of the SOL days plotted to show the range of performance experienced on the Martian surface.

19869 **Possible markets for kilogram quantities of ^{241}Am.** Mangeng, C.A.; Kennan, T.K.; Thayer, G.R. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **45**: 243(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

08 Production

REFER ALSO TO CITATION(S) 19879, 19921

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 20577

19870 **(DOE/CE/15095—13) Introduction to biogas production on the farm.** (National Center for Appropriate Technology, Butte, MT (USA)). Mar 1984. Contract AC01-82CE15095. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009730.

A number of farmers, ranchers, and engineers received support from the US Department of Energy Appropriate Technology Small Grants Program to design, construct, and demonstrate biogas production systems. Many of these projects generated more than just biogas; grantees' work and results have contributed to a growing body of information about practical applications of this technology. This publication was developed to share some of that information, to answer the basic questions about biogas production, and to lead farmers to more information. Section I introduces biogas and the various components of a biogas production system, discusses the system's benefits and liabilities, and provides a brief checklist to determine if biogas production may be applicable to an individual's particular situation. Section II features descriptions of four biogas projects of various sizes. Section III provides sources of additional information including descriptions of other biogas production projects.

19871 **(DOE/ER/10720—14) CO and CO_2 hydrogenation over ZrO_2.** He, M.Y.; Ekerdt, J.G. (Texas Univ., Austin (USA). Dept. of Chemical Engineering). 1984. Contract AS05-80ER10720. 20p. (CONF-840415—17). NTIS, PC A02; 3; GPO Dep. Order Number DE84009146.

From 187. national meeting of the American Chemical Society; St. Louis, MO, USA (8 Apr 1984).

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The hydrogenation of CO and CO_2 over ZrO_2 is classified as isosynthesis (the selective formation of branched alkanes and aromatics) when the reaction is conducted at pressures on the order of 50 to 200 atm. The reaction is known to produce intermediate oxygenated products, including methanol and dimethyl ether, suggesting that the isosynthesis reaction may proceed via oxygenated intermediates. This paper examines the C_1 intermediates which may initiate the isosynthesis reaction as well as participate in propagation. The presence of intermediates and their interconversion were established at one atm using temperature programmed techniques and FT-IR. The C_1 intermediates formed on ZrO_2 can be expected to be the same at one atm and isosynthesis pressures, however, their relative abundances may differ. Different mechanisms have been proposed for CO and CO_2 hydrogenation over metal oxides. Possible C_1 intermediates include: formyl, formate, and molecular formaldehyde as the initial intermediate which forms between CO/H_2 and the metal oxide, and methoxide and hydroxycarbene as precursors to methane or methanol. Our previous work over ZrO_2 has shown that carbonate, bicarbonate, formate and methoxide form upon adsorption of CO/H_2 or CO_2/H_2. Labeling studies are used to examine the interconversion of these intermediates and assist in establishing the mechanism for CO or CO_2 hydrogenation over ZrO_2. 22 references, 5 figures.

19872 **(DOE/ER/10880—T2) Methane producing bacteria: immunological characterization. Final report, April 1, 1981-March 31, 1984.** de Macario, E.C.; Macario, A.J.L.; Wolin, M.J. (New York State Dept. of Health, Albany (USA). Center for Labs. and Research). Mar 1984. Contract AC02-81ER10880. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009344.

Methanogenic bacteria, or methanogens, were studied systematically with immunologic techniques. A comprehensive bank of reference antisera was organized from which calibrated antibody probes were generated of high resolution power for rapid bacterial identification and classification, and for examining samples from complex ecosystems. A method was standardized for antigenic fingerprinting methanogens. The major finding was that these bacteria form an immunologically coherent group, with subgroups of antigenically related members. Antigenic relationships paralleled the phylogenetic organization delineated by comparisons of 16S rRNA nucleotide sequences, and by cell-wall chemistry. Thus, immunologic data emerged as one of the three basic tenets of the notion that methanogens belong in a third primary kingdom, the archaebacteria, evolutionarily different from eubacteria and eukaryotes. The findings, methods and antibodies produced by work supported by this grant proved also of practical usefulness in various applications, notably monitoring the bacterial flora of bioreactors. Direct examination of specimens is now possible by simple and specific immunologic procedures, in a few hours. The full potential of the new methodology will be explored in the immediate future.

19873 **(DOE/ET/13376—T1) Appendix B. Interim progress report, October 1, 1978-December 31, 1979.** Satterfield, C.N.; Longwell, J.P.; Huff, G.A. Jr. (Massachusetts Inst. of Tech., Cambridge (USA)). 1979. Contract AT01-76ET13376. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009345.

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We can make some comments about the overall rate constant based on our experimental work and on previous work on the Fischer-Tropsch synthesis in the vapor phase for an iron catalyst, and founded on our experience with mass transfer in general. First, the intrinsic component reportedly has an activation energy of 17 to 27 kcal/mole (appendix A) while the mass transfer term should be around 5 kcsl/mole. In other words, there is a striking difference for the temperature dependency of mass transfer and of the intrinsic reaction that make up the overall rate constant. As is often the case, intrinsic kinetics dominate at lower temperatures but mass transfer at higher temperatures. Second, when only the degree of agitation is changed, the mass transfer term will vary while the intrinsic rate component remains constant. Specifically, for our experimental apparatus, gas bubble size decreases and gas hold-up increases as the shear-rate increases with more rapid stirring speeds. As a result, there is more gas in the slurry with a larger surface area for mass transport, and, hence, the mass transfer component diminishes as agitation increases. For this report, we dwell on the rate of synthesis gas disappearance. However, preliminary evidence is presented to suggest that mass transfer also markedly affects the product distribution.

19874 **Stoichiometries of H_2 and CO adsorptions on cobalt: effects of support and preparation.** Reuel, R.C.; Bartholomew, C.H. (Brigham Young Univ., Provo, Utah). *Journal of Catalysis;* **85**: No. 1, 63-77(Jan 1984). Contract AC02-81ER10855.

Catalysts composed of unsupported cobalt and cobalt supported on silica, alumina, titania, magnesia, and carbon were prepared by thermal decomposition, impregnation, precipitation, and evaporative deposition. These catalysts were characterized by high temperature (323-423 K) hydrogen adsorption and conventional 298 K adsorptions of hydrogen and carbon monoxide. Total surface areas of unsupported cobalt catalysts were measured by BET. Metal crystallite sizes were determined independently from XRD, TEM, and hydrogen adsorption. Extents of reduction were measured by O_2 titration at 673 K. Hydrogen adsorption on cobalt is activated and reversible; extents of activation and reversibility vary with support, metal loading, and preparation. The hydrogen adsorption stoichiometry is 1.0 hydrogen atom per surface cobalt atom, if total adsorption at the temperature of maximum uptake is considered. The adsorption of CO is nonactivated and reversible; the stoichiometry for irreversible adsorption varies from 0.4 to 2.3 molecules of CO per surface cobalt atom, depending upon support, metal loading, and preparation. Cobalt dispersion and extent of reduction also vary greatly with support, metal loading, and method of preparation. Cobalt/carbon catalysts prepared by evaporative deposition have unusually high dispersions relative to other cobalt catalysts. Hydrogen adsorption is recommended as the most convenient, reliable technique for measurement of cobalt crystallite size in Co/Al_2O_3, Co/SiO_2, and Co/C catalysts. 4 figures, 3 tables.

19875 **Effects of support and dispersion on the CO hydrogenation activity/selectivity properties of cobalt.** Reuel, R.C.; Bartholomew, C.H. (Brigham Young Univ., Provo, Utah). *Journal of Catalysis;* **85**: No. 1, 78-88(Jan 1984). Contract AC02-81ER10855.

Specific activities and selectivities of unsupported cobalt and cobalt supported on alumina, silica, titania, carbon, and magnesia carriers for CO hydrogenation were measured in a single-pass differential reactor at low conversions, 1 atm, and 175-350°C. The results indicate that specific activity and selectivity of cobalt vary with support, dispersion, metal loading, and preparation method. The order of decreasing CO hydrogenation activity at 1 atm and 225°C for catalysts containing 3 wt% cobalt is Co/TiO_2, Co/SiO_2, Co/Al_2O_3, Co/C, and Co/MgO. The specific activity of cobalt decreases significantly with increasing dispersion. Product selectivity is best correlated with dispersion and extent of reduction, i.e., the molecular weight of hydrocarbon products is lower and the CO_2/H_2O ratio is higher for catalysts having higher dispersions and lower extents of reduction. This effect may be due to stable oxides in the well-dispersed, poorly reduced catalysts, which catalyze the water-gas-shift reaction thereby increasing the H_2/CO ratio at the surface. In the Co/Al_2O_3 system, activity and selectivity for high molecular weight hydrocarbons increase very significantly with increasing cobalt loading. A 15% Co/Al_2O_3 is 20 times more active than 3% Co/Al_2O_3; moreover, 86 wt% of its hydrocarbon fraction is in the C_5-C_{12} (gasoline) range compared to 18 wt% for 3% Co/Al_2O_3. 5 figures, 5 tables.

19876 **Influence of adsorption and mass transfer effects on temperature-programmed desorption from porous catalysts.** Rieck, J.S.; Bell, A.T. (Univ. of California, Berkeley). *Journal of Catalysis;* **85**: No. 1, 143-153(Jan 1984). Contract AC03-76SF00098.

A theoretical analysis is presented for temperature-programmed desorption (TPD) from a bed of catalyst perfused by a flow of carrier gas. The bed is modeled either as a single CSTR or as multiple CSTR's connected in series. The number of CSTR's required is governed by the product of Schmidt and Reynold's number, ScRe. The model developed in this paper is used to calculate TPD spectra for the desorption of CO and H_2 from the surface of a Group VIII metal. It is established that the position and shape of the spectra are sensitive functions of catalyst particle size, catalyst bed depth, carrier flow rate, and carrier gas composition. The effects of nonuniformities in the initial distribution of adsorbate are also examined. For small particle diameters, such nonuniformities are rapidly annealed by intraparticle diffusion, and as a consequence have little effect on the shape or position of the TPD spectrum. For larger particle diameters, distortions of the spectrum due to nonuniform adsorbate distribution are expected. The theoretically generated TPD spectra are used to evaluate the applicability of a relationship developed for describing equilibrium desorption in the absence of mass transfer effects. Reasonably accurate estimates of the enthalpy of adsorption can be obtained from this relationship, but its use to determine the preexponential factor for desorption produces large errors when significant mass transfer effects are present. 12 figures, 4 tables.

19877 **Mechanism of strong metal-support interaction in Ni/TiO_2.** Chung, Y.W.; Xiong, G.; Kao, C.C. (Northwestern Univ., Evanston, IL). *Journal of Catalysis;* **85**: No. 1, 237-243(Jan 1984). Contract AC02-78ER04946.

Catalytic CO hydrogenation reactions were performed on several differently prepared Ni/TiO_2(100) and TiO/sub x//Ni(100) model catalysts at 190°C, P/sub H_2/ = 60 Torr and P/sub CO/ = 20 Torr. It was found that hydrogen reduction at 500°C before or after Ni deposition on TiO_2(100) always results in an enhanced steady-state methanation activity, accompanied by a lower surface carbon level. The ethylene/methane ratio, however, is independent of such treatments and is always about twice that from Ni(111). XPS studies showed that Ni/TiO_2 catalysts prepared by different methods have similar surface Ti/sup 3+/ concentration. The TiO/sub x//Ni(111) catalyst has a methanation activity and ethylene/

methane ratio similar to $Ni/TiO_2(100)$ at an optimum titanium coverage of 8% of a monolayer. Based on these results, the authors propose one model for strong metal-support interaction in which the presence of titania on the metal surface induced by high-temperature treatment and the possible incorporation of surface or subsurface hydrogen act synergistically to modify and maintain the activity of titania-supported catalysts. 2 figures, 2 tables.

19878 **Showy milkweed, Asclepias speciosa: a potential new semi-arid land crop for energy and chemicals.** Adams, R.P. (Native Plants, Inc., Salt Lake City, UT); Balandrin, M.F.; Martineau, J.R. *Biomass;* 4: No. 2, 81-104(1984). Contract AC03-81CS84009.

Research on the chemical composition and domestication trials of Asclepias speciosa, showy milkweed, is presented. Biomass yields were approximately 4.3 ton/ha (1.9 ton/acre) but increased plant density is expected to raise these yields considerably. The milkweeds were harvested with standard haying equipment and baled as with alfalfa hay. Storage tests in ambient conditions indicated that the non-polar extractables. were stable whereas the polar extractables declined approximately 40% after about 2 months and stabilized at that level after five months. Storage in dry conditions resulted in only small losses. The non-polar extracts consist principally of α- and β-amyrins and their acetate esters. The methanol extracts contain mostly sucrose and inositol. Milkweed extractives are compared to fossil fuels and cracking to liquid fuels is discussed along with various alternative uses for the extracted residue. The use of milkweed as a new crop depends on weed control, increased yields, product development and the development of commercial extraction and purification technology. 46 references, 3 figures, 12 tables

19879 **Levelized life-cycle costs for four residue collection systems and four gas production systems.** Thayer, G.R.; Rollett, H.; Rood, P.L.; Williamson, K.D. (Los Alamos National Laboratory, Los Alamos, NM). pp 1263-1286 of Energy from biomass and wastes VII. Chicago, IL; Inst. of Gas Tech. (1983). (CONF-830114—).

From 7. annual symposium on energy from biomass and wastes; Lake Buena Vista, FL, USA (24 Jan 1983).

Technology characterizations and life-cycle costs were obtained for four residue collection systems and four gas production systems. All costs are in constant 1981 dollars. The residue collection systems were cornstover collection, wheat straw collection, soybean residue collection, and wood chips from forest residue. The life-cycle costs ranged from $19/ton for cornstover collection to $56/ton for wood chips from forest residues. The gas production systems were low-Btu gas from a farm-size gasifier, solar flash pyrolysis of biomass, methane from seaweed farms, and hydrogen production from bacteria. Life-cycle costs ranged from $3.3/10^6$ Btu for solar flash pyrolysis of biomass to $9.6/10^6$ Btu for hydrogen from bacteria. Sensitivity studies were also performed for each system. The sensitivity studies indicated that fertilizer replacement costs were the dominate costs for the farm residue collection, while residue yield was most important for the wood residue. Feedstock costs were most important for the flash pyrolysis. Yields and capital costs are most important for the seaweed farm and the hydrogen from bacteria system.

19880 **Operation of an upflow fixed-bed anaerobic digester for waste stabilization and fuel gas production at near-commercial scale.** Genung, R.K.; Donaldson, T.L.; Harris, M.T.; Rivera, A.L. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 647-670 of Energy from biomass and wastes VII. Chicago, IL; Inst. of Gas Tech. (1983). (CONF-830114—). Contract W-7405-ENG-26.

From 7. annual symposium on energy from biomass and wastes; Lake Buena Vista, FL, USA (24 Jan 1983).

An anaerobic, upflow (ANFLOW) bioreactor, which uses fixed-films of bacteria in a packed-bed column, is being developed on a nearcommercial scale as an energy-conserving wastewater treatment process. Development efforts have progressed through a successful two-year feasibility study with a 19 m^3/d system in Oak Ridge, Tennessee. Process engineering studies are currently being conducted in Knoxville, Tennessee, with a 190 m^3/d ANFLOW pilot plant. Studies with this pilot plant began in August 1981 and will be conducted for a total of 18-20 months. A commercial ANFLOW unit of this size could handle the municipal wastewater produced by approximately 250-500 people. Larger systems could be constructed using this basic module. Comparisons between ANFLOW and conventional wastewater systems are being developed.

19881 **Anaerobic digestion of municipal solid waste to produce methane.** Walter, D.K. (Energy from Municipal Waste, U.S. Department of Energy, Washington, DC). pp 705-740 of Energy from biomass and wastes VII. Chicago, IL; Inst. of Gas Tech. (1983). (CONF-830114—).

From 7. annual symposium on energy from biomass and wastes; Lake Buena Vista, FL, USA (24 Jan 1983).

A proof of concept facility designed to anaerobically digest municipal solid waste to produce methane has been operating on a private landfill near Pompano Beach, Florida since mid 1978. The system was designed to accept up to 100 tons per day (TPD) of raw refuse. Earlier reports have detailed various problems. These to a large part have been solved. The purpose of this paper is to note some of the more significant changes and to present the results to date. This process has four distinct areas that required developmental work, they are: solid waste preparation, feed proportions and mixing, digestion and digester design, and effluents management. The solid waste preparation system has been simplified significantly and now works well. The digestion process has been stabilized and digester design parameters developed. The system has been producing 7 to 8 SCF of biogas per pound of volatile solids fed (compared to 6 SCF expected from laboratory results). No free water is being discharged from the facility beyond that contained in the filter cake. The filter cake is averaging 25% solids from a vacuum filter.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 19626, 19871, 19910, 20407, 20932

19882 **(DOE/CS/20002—T1) Enzymatic hydrolysis of cellulose to glucose: a report on the Natick Program. Final report.** (Army Natick Research and Development Command, MA (USA). Science and Advanced Technology Lab.). Sep 1981. Contract AI01-76CS20002. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009220.

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Contributions of Natick to enzymatic hydrolysis and the development of cellulase technologies are summarized. Their impact on the present economics of a commercial process is highlighted. Discussion is presented under the headings: microbial strains; growth and enzyme production in Trichoderma reesei; enzyme properties, analysis and assay; hydrolysis substrates; pretreatment; hydrolysis; process development and economics; and outlook and future developments. 99 references, 11 figures, 4 tables. (DMC)

19883 **(DOE/PC/30265—T1) Methanol and methyl fuel catalysts. Final technical report, September 1980-August 1983.** Klier, K.; Herman, R.G.; Simmons, G.W. (Lehigh Univ., Bethlehem, PA (USA). Center for Surface and Coatings Research). Dec 1983. Contract FG22-80PC30265. 109p. NTIS, PC A06/MF A01. Order Number DE84004643.

Copper-based catalysts for alcohol synthesis were prepared, tested for catalytic activity and selectivity, and characterized. These catalysts include Cu/ZnO, Cu/Co/ZnO, $Cu/Co/Cr_2O_3$, Cu/ $Co/Cr_2O_3/K_2O$, and Cu/ZnO/KOH. The chromia-containing catalysts exhibited a low activity and selectivity, while the Cu/ZnO catalyst was verified to be a very active and selective methanol synthesis catalyst. Cobalt imparted a methanation function to the catalysts, while potassium suppressed the activity and the selectivity. Over the quaternary catalyst, higher pressure and lower GHSV enhanced the selectivity to higher alcohols. Low concentrations of carbon dioxide in H_2/CO synthesis gas over Cu/ZnO catalysts promote methanol synthesis, while at high concentrations it behaves as a retardant of the synthesis. The water gas shift reaction readily proceeds over the Cu/ZnO catalyst. Analogous to the CO_2 effect, the presence of water in the synthesis gas has a profound effect on the synthesis of methanol. The Cu/ZnO catalyst is a good hydrogenation catalyst. Olefins, aldehydes, and acids are hydrogenated at

a faster rate than CO is hydrogenated to methanol, but aromatics are hydrogenated at slower rates. Chemical trapping of the intermediates on these surface sites with amines demonstrates that a kinetically significant intermediate in methanol synthesis is a surface formyl or hydroxycarbene species. These species can be formed from synthesis gas or by alcohols in the reactant stream, and they readily alkylate amines in the reactant gas stream. Over an Fe/Cu/ZnO catalyst, amines inhibit the production of alcohols by trapping the precursor intermediates, while changing the hydrocarbon selectivity from paraffins to predominantly olefins. 68 references, 9 figures, 25 tables.

19884 **(DOE/R7/01160—T1) Producing enzymes from molds to convert cellulose into glucose and alcohol. Final report.** Bassi, S.; Curran, P. (Benedictine Coll., Atchison, KS (USA)). 29 Nov 1982. Contract FG47-80R701160. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010012.

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The following significant results were obtained: (1) extracts of various tree barks were made and used to determine if any of the chemicals had growth stimulating effects on the molds. The extracts from the oak and elm tree bark were very active in inducing and stimulating the mycelial growth of the molds Trichoderma reesei, Pleurotus ostreatus and Aspergillus awamori. Efforts to determine what specific chemical caused the increase in growth were unsuccessful but are being continued. This information will be very useful because it was discovered that by speeding and increasing the growth of the mold cells, it was also possible to speed and increase the production of the enzymes; (2) efforts to cultivate the mold Pleurotus ostreatus in the same culture with Trichoderma reesei were successful. When the two molds were cultured on an enriched cellulose media, it was discovered that the reesei produced large amounts of the beta glucosidase. Reesei produces very small amounts of this enzyme under normal conditions but this high production under coculture conditions may be due to the fact that Pleurotus ostreatus removes the glucose formed from the cellulose breakdown. Trichoderma reesei produces cellulases which convert cellulose into cellobiose and cellobiose is converted to glucose by the enzyme beta-glucosidase. In the presence of glucose the gene producing beta-glucosidase is repressed by the feedback mechanism. These surplus enzymes can then be used for saccharifying cellulose from wastepaper, wood pulp, cornstalks, wheat straw and other cellulosic materials and eventually produce alcohol; (3) efforts to produce mutants of the Trichoderma reesei by using the uv irradiation were unsuccessful; and (4) Zymomonas mobilis is capable of faster fermentation. The only drawback is that only low concentrations of glucose can be used. Mutants of Zymomonas resistant to higher alcohol levels would help in this process and are being looked into.

19885 **(DOE/R7/01171—T1) [Flash vaporization of alcohol-water mash]. Final technical report.** Lustgarten, J.C. (Lustgarten (Jim C.), Omaha, NE (USA)). 1984. Contract FG47-80R701171. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84010003.

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Original design constraints of flash vaporization of the entire liquid fraction of a fermented mash met with many operational considerations which presented difficulty in obtaining the desired effect. In addition, theoretical parameters within the original design led to several modifications of the original design. Modifications to provide the necessary latent heat to accomplish flash vaporization included many tangental approaches. The use of electromagnetic radiation to penetrate the high vacuum of the separation-dehydration chamber indicated that flash vaporization using this method was technologically feasible, but due to the high energy demands and the typical operator's unfamiliarity with the usage of electromagnetic waves for heating, this modification was deemed as impractical. The process of surface absorption of the latent heat from the outside environment, while necessitating stringent high vacuum conditions, could possibly be used in warm climate environments. Although the use of a forced condenser is required to lower vacuum pump volume capacities, a substantial energy gain is obtained if the extremely large surface area of the separation-dehydration chamber is observed. The most promising development from a small scale process is involved with the use of the newly developed spray dryers currently on the market. This equipment may prove cost effective for small scale applications where the production of distillers dried grains and solubles is important. This process lacks the high energy efficiencies experienced with the high vacuum surface absorption method, but the operating parameters are technologically easier to maintain. It is recommended that any further research along the lines of flash vaporization of the alcohol-water mash, with concurrent separation and dehydration of the distillers grains and solubles, be along these lines of development.

19886 **(ORNL/Sub—81/24707/2) Coal Liquefaction Technology Assessment. Phase II. Texaco gasification. Final report.** (Fluor Engineers and Constructors, Inc., Houston, TX (USA)). Mar 1984. Contract AC05-84OR21400. 438p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE84010163.

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This report represents Phase II (Texaco gasifier cases) of a multi-phase Coal Liquefaction Technology Assessment Study. The purpose of this effort is to provide technical and cost information in support of the task of comparing coal liquefaction processes on a consistent basis. The conceptual designs presented in Phase II are representative of first and second generation processes for producing methanol fuels from coal. These processes are also indirect coal liquefaction processes; coal is gasified, then converted to liquid products. Four conceptual designs have been prepared: Case TXW: Texaco gasifiers - Western subbituminous coal; Case TXE: Texaco gasifiers - Eastern bituminous coal; Case KW: Koppers gasifiers - Western subbituminous coal; and Case KE: Koppers gasifiers - Eastern bituminous coal. Wyoming Wyodak coal (identical to the coal used in Phase I) and Illinois Herrin 6 coal were used in this study as representative of western and eastern coals. Analyses of these coals are presented in Appendix C. In each Phase II case, 16,000 T/D of MAF coal (identical to Phase I) are fed to the gasifiers. Unleaded gasoline via the fixed-bed Mobil MTG process is the primary product. Propane and butane LPG are also produced in each case. Capital investment and operating costs were developed for each of the four cases based on mid-1979 costs. No projection has been included for escalation. Cost estimates are presented for the Texaco gasifier cases only in this report.

19887 **(PNL-SA—11878) Catalytic steam gasification of bagasse for the production of methanol.** Baker, E.G.; Brown, M.D. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-65RL01830. 22p. (CONF-831268—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006580.

From 8. energy from biomass and wastes meeting; Lake Buena Vista, FL, USA (10 Dec 1983).

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Pacific Northwest Laboratory (PNL) tested the catalytic gasification of bagasse for the production of methanol synthesis gas. The process uses steam, indirect heat, and a catalyst to produce synthesis gas in one step in fluidized bed gasifier. Both laboratory and process development scale (nominal 1 ton/day) gasifiers were used to test two different catalyst systems: (1) supported nickel catalysts and (2) alkali carbonates doped on the bagasse. This paper presents the results of laboratory and process development unit gasification tests and includes an economic evaluation of the process. 20 references, 6 figures, 9 tables.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 19901, 20404

19888 **(ANL/CNSV-TM—125) National survey of industrial markets for steam produced from burning municipal solid waste.** Pearson, C.V. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 165p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84009134.

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This report presents the methodology and findings of an analysis to determine the maximum size of the industrial market for

steam produced from municipal solid waste in the United States. The data used in the analysis were developed from the 1980 census report and the US Chamber of Commerce's 1979 Standard Industrial Classification (SIC) listing. The process used to match potential steam users with populations large enough to generate suitable quantities of waste is presented. No attempt was made to rank the markets or analyze the market economics.

19889 **(CONF-840302—2) Utility ownership of the wood resource as an option for secure fuel supply.** Mueller, R.O.; Stavrou, J. (Argonne National Lab., IL (USA)). 1984. Contract W-31109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009158.

From 11. annual energy technology conference and exposition; Washington, DC, USA (19 Mar 1984).

The purpose of this paper is to identify and compare the basic options available to a utility to deal with the risks of wood supply uncertainty. As we show in this paper, through proper actions a utility can eliminate the problems of uncertain wood supply. One option, building plants with dual-fuel capability (or at least designing plants that permit the retrofitting of a nonwood fuel-using capability at some future time) is an obvious step toward capping the effects of unexpectedly higher wood prices and should probably be done in all cases. However, since the objective in building a wood-fired plant (and foregoing the economies of scale possible with conventional fuels) is presumably to use wood, a utility may attempt to more directly secure an adequate wood supply through long-term contracts with landowners or direct land ownership. Both the contract and ownership options have been widely used in the forest products industry, and both can clearly be applied to a utility using fuel wood. Moreover, contrary to the widely held view that long-term secure contracts cannot be written, the key point is that they can be effected if written with landowners and not fuel suppliers. Direct utility ownership may be required to introduce advanced fuel wood production methods (such as short rotation forest plantations) into its supply area. While still in the research and development state, these advanced fuel wood production methods are expected to provide technically viable and cost-effective alternatives for augmenting the conventional fuel wood sources. As a component of an integrated wood procurement strategy, utility ownership of a fuel wood plantation would not only offer security (and augmentation) of supply, but also would provide a utility with significant market power in dealing with its conventional suppliers and landowners.

19890 **Instabilities in air classification of fuels.** Taub, J.B.; Peirce, J. (Dept. of Civil and Environmental Engrg., Duke Univ., Durham, NC). *Journal of Solar Energy Engineering;* **109**: No. 2, 74-87(Jun 1983). Contract AC05-79CS20544.

The impact of feed composition on the stability of air classification in waste-to-energy production facilities is analyzed. Vertical air classification is one means of separating combustible organic matter from non-combustible inorganics typically found in municipal solid waste. Aerodynamically light organics ideally exit upward with air flow, while heavy inorganics ideally exit downward against the current. Problems develop in practice as organic matter is lost downward and inorganic matter exits upward to contaminate the fuel product. Utilizing a lab-scale vertical classifier, the overall efficiency and the sensitivity of the efficiency to air velocity is determined for several feed compositions. Particle-to-particle interaction is observed for a variety of feed compositions, and the effect this interaction has on the quality of the fuel product is documented. Results suggest modification to the design and operation of waste-to-energy fuel production facilities. Feed material to the classifier that is high in organic matter is seen to be not necessarily useful in producing a clean fuel product. Pre-processing techniques are suggested to polish this feed prior to air classification.

19891 **Predicting air classifier performance.** Peirce, J.J.; McNabb, M.; Vesilind, P. (Dept. of Civil and Environmental Engrg., Duke Univ., Durham, NC). *Journal of Solar Energy Engineering;* **109**: No. 1, 7-16(Mar 1983). Contract AC05-79CS20544.

A test predicting air classifier performance is developed and evaluated in a waste-to-energy production facility. The separation of combustibles from noncombustibles is critical to the success of any waste-to-energy production facility. Air classifier technologies are relied on to aid in their separation, but often the technologies are applied to unsuitable waste flows. Costly design and operating mistakes are the rule and not the exception. Using samples of municipal solid waste, a test to predict success, both easy and economical to conduct, is considered in terms of its principles, the test methodology, and experimental results, as well as air classification comparisons. Conclusions are drawn which indicate the strengths and limitation of this method of prediction.

13 HYDRO ENERGY

1301 Resources And Availability

19892 **(AD-A—134359/9) Water control data system software manual. Final report.** (Corps of Engineers, Dallas, TX (USA). Southwestern Div.). Feb 1983. 192p. NTIS, PC A09/MF A01.

This reports describes the Southwestern Division, Corps of Engineers Water Control Data Collection and Analysis requirements and presents an overall system of software to satisfy those requirements of the water control manager. There is a brief summary of data collection, analysis, distribution, and data exchange requirements in SWD. The hardware comprising the SWD data collection and transmission system is briefly described. The primary method of transmitting information from remote gage sites is via the Geostationary Orbiting Environmental Satellite (GOES) Systems. Processing of the data is done by a network of minicomputers located at three (3) district offices and the division office. The manual details the water manager user requirements as to the products needed. The software system consisting of acquisition group, data base, analysis group and data base utility group. Also interfacing with these groups is system support software required to provide a 'user friendly' system. Within each major group are various programs and routines which interact to form the system. This system is designed to perform in an interactive mode.

1302 Site Geology And Meteorology

19893 **(NMERDI—2-71-4223) Study of hydraulic power recovery from New Mexico water distribution systems.** Schoenmackers, R. (New Mexico Solar Energy Inst., Las Cruces (USA)). Feb 1984. 51p. NMERDI Information Center, Univ. of New Mexico, 457 Washington, SE, Albuquerque, NM 87108.

The results of a survey of New Mexico water distribution systems suitable for hydroelectric power development are reported. The objectives of the survey were to determine the potential for hydraulic power recovery from existing and planned water systems, to identify potential sites, and to study and recommend promising sites for further development. The survey found eleven sites in New Mexico water distribution systems with a total hydroelectric power potential of 736 kilowatts. Seven of these sites, or 439 kilowatts, could be developed immediately, having everything necessary in place but the turbine generator. These sites are located in the Bonito pipeline near Carrizozo (2 sites), Raton, Ruidoso, Santa Fe, Sugarite, and Taos. If all seven sites were developed, the annual energy production could reach 3,800,000 kilowatt hours.

1303 Plant Design And Operation

19894 **(PB—84-140516) Integrating intermittent and renewable power resources into the hydropower system of the Pacific Northwest. Technical report.** Millham, C.B. (Washington State Water Research Center, Pullman (USA)). Jul 1983. 121p. NTIS, PC A06/MF A01.

This report discusses the extent to which hydropower could be used to 'smooth' and back up intermittent and unreliable power sources, including solar water heaters, solar irrigation pumps, and wind-generation turbines. The amounts of power involved in each are developed, and economic evaluations are given. Because the volumes of power are potentially relatively large and because the

economics of wind turbines are potentially competitive, the bulk of the work focuses on these units. The tool of analysis is a 51-reservoir, 56-time-period computer simulation model of the hydropower system in the Snake and Columbia Rivers and tributaries.

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 20868, 20869, 20870

19895 **(DOE/BP—225) Cumulative effects of micro-hydro development on the fisheries of the Swan River drainage, Montana. First annual progress report (covering field season July-November 1982).** Leathe, S.A.; Graham, P.J. (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA). Fisheries Research and Special Projects Bureau). 1983. Contract AI79-82BP36717. 80p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84010094.

This fisheries study is to determine the potential cumulative biological and economic effects of 20 small or micro-hydro-electric facilities (less than 5 megawatts) proposed to be constructed on tributaries to the Swan River, a 1738 square kilometer (671 square mile) drainage located in northwestern Montana. The study addresses portions of measure 1204 (b) (2) of the Norwthwest Power Planning Council's Columbia River Basin Fish and Wildlife Program. Aerial pre-surveys conducted during 1982 identified 102 stream reaches that may support fish populations in the Swan drainage between Swan and Lindbergh lakes. These reaches were located in 49 tributary streams and constituted 416 kilometers (258 miles) of potential fish habitat. Construction of all proposed small hydro projects would divert water from 54 kilometers (34 miles) or about 13 percent of the tributary system. Only two of the 20 proposed hydro sites did not support trout populations and most were populated by migratory bull trout and westslope cutthroat trout. Potential cumulative habitat losses that could result from dewatering of all proposed project areas were predicted using a stream reach classification scheme involving stream gradient, drainage ara, and fish population data. Preliminary results of this worst case analysis indicate that 23, 19 and 6 percent of the high quality rearing habitat for cutthroat, bull, and brook trout respectively would be lost.

19896 **(DOE/SW/13008—T1) Investigations of causes of trout mortality in artificial cold water fisheries below hydropower facilities in the Southwest. Final report.** Zimmerman, E.G.; Beitinger, T.L. (North Texas State Univ., Denton (USA). Dept. of Biological Sciences). Nov 1982. Contract AC75-82SW13008. 76p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84009459.

The potential causes of mortalities of trout residing in the tailwaters of several southwestern hydropower reservoirs were assessed by (1) and extensive literature review and (2) limited field activities. Tailwaters downstream from the following reservoirs were considered: Tenkiller, Oklahoma (Illinois River), Beaver, Table Rock, Bull Shoals, Norfork and Greers Ferry in the White River basin, Arkansas. 163 references, 5 figures, 13 tables.

19897 **(FERC/EIS—0023) Federal Energy Reaulatory Commission Office of Electric Power Regulation final environmental impact statement: Tyee Lake Project FERC No. 3015 - Alaska.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Jun 1981. 231p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84009434.

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Alaska Power Authority (Applicant) of Anchorage, Alaska, proposes to construct a hydroelectric project with an installed generating capacity of 20 MW on Tyee Creek in Tongass National Forest near Wrangell, Alaska. The action proposed by the Applicant would require (1) a lake tap intake structure in Tyee Lake at approximately 1230 feet elevation; (2) approximately 8700 feet of shaft and tunnel for water conveyance; (3) a powerhouse near the Bradfield Canal; (4) approximately 1100 feet of channel from the powerhouse tailrace to Airstrip Slough; (5) 69 miles of overhead and 12 miles of submarine transmission line; (6) approximately 1 mile of access road; and (7) other appurtenant facilities. Construction would commence subsequent to issuance of a license.

19898 **(FERC/EIS—0026) Terror Lake Hydroelectric Project, FERC No. 2743, Alaska. Final environmental impact statement.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Aug 1981. 409p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84009342.

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Kodiak Electric Association, Inc. (KEA), of Kodiak, Alaska, a non-profit cooperative corporation, organized under the laws of the State of Alaska, proposes to construct a 20-MW conventional hydroelectric project by using the hydroelectric potential of Terror Lake, a natural lake located within the Kodiak National Wildlife Refuge, in a glaciated valley, 40 miles southwest of the City of Kodiak, Alaska. The proposed development would require the construction of a rock-fill dam, 2100 feet in length, with a maximum height of 156 feet above bedrock, and would contain 906,000 cubic yards of fill material. The 270-acre natural lake would be inundated and replaced by the newly created 850-acre reservoir. Other project features would include: (1) a 17-mile-long access road; (2) a jetty at the head of Kizhuyak Bay; (3) a 17.3-mile-long, 138-kV transmission line; (4) four diversion dams and ponds; (5) a 26,311-foot-long power tunnel; (6) a 3400-foot-long penstock; (7) a surface powerhouse with two 10-MW turbine generators; (8) recreational facilities; and (9) a temporary construction camp on the Bay.

1307 Power Conversion Systems

REFER ALSO TO CITATION(S) 19978

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 20354, 20355, 20356

1404 Environmental, Legal, And Institutional Aspects

19899 **(DOE/SF/10501—306) Wildlife interactions at Solar One. Final report.** McCrary, M.D.; McKernan, R.L.; Flanagan, P.A.; Wagner, W.D. (Los Angeles County Natural History Museum Foundation, CA (USA). Section of Ornithology). Jan 1984. Contract FC03-77SF10501. 40p. (STMPO—606). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84006965.

The purpose of this final report is to provide the results of the study period from December 1982 through May 1983 and to report on the overall impact of the facility on wildlife. During 102 days of study 107 bird species and over 22,000 individuals were counted in the vicinity of Solar One. This high bird use of the Solar One study area in comparison to the sparse population of most of the Mojave desert is a result of the close proximity of Solar One to extensive (53 ha) ponds and active agricultural fields. Almost all cases of incineration at Solar One involved aerial insects. In most cases the identity of the actual species involved could not be determined, but most incinerations probably involved dragonflies, wasps, bees, and butterflies. Unlike insects, the incineration of birds in the standby points is a rare occurrence. During the 14 month period from April 1982 through May 1983, only 6 bird incinerations were known to have occurred at Solar One. Avian collisions with plant structures, especially heliostat mirrors were more frequent than incinerations. Considering all known avian fatalities regardless of cause of death in the 14 month period from April 1982 through May 1983, 60 birds may have died as a direct result of Solar One operation. This low mortality in relation to the high bird use of the study area indicates that the impact of Solar One on birds after initial construction is minimal. The results of this study suggest that, to insure the minimal impact of this technology on birds, future solar central receiver power plants in the Mojave desert should not be sited in close proximity to open water or other areas of high bird use.

19900 (NP—4900506) Potential energy contribution from solar resources by 1990: a preliminary assessment. King, R.J. (Texas Energy and Natural Resources Advisory Council, Austin (USA)). 22 Aug 1978. 20p. NTIS, PC A02/MF A01. Order Number DE84900506.

This report lays out one possible scenario for development of renewable energy resources. It is suggested that the State of Texas could derive 3 to 5% of expected 1990 energy demand form renewable resources. The potential for the following resources are discussed: solar water heating and pool heating; solar heating and cooling of buildings; industrial process heat and steam, solar electric power, windpower, crops and residues, wood wastes and wood farming, and municiple solid waste. Implications for employment is Texas are also discussed.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 19870, 19878, 19879, 19882, 19884, 19885, 19887, 19889, 20346, 20347, 20404, 20407, 20428, 20730, 20876

19901 (ANL/CNSV-TM—127) Energy from biomass: building on a generic technology base. (Argonne National Lab., IL (USA)). Jan 1984. Contract W-31-109-ENG-38. 95p. (CONF-830898—). NTIS, PC A05/MF A01; GPO Dep. Order Number DE84007083.

From 1. conference on energy from biomass: building on a generic technology base; Argonne, IL, USA (22 Aug 1983).

This volume contains the 14 technical papers presented at the meeting. The purpose of the meeting was to transfer findings from government and private research to industries to stimulate the commercialization of biomass energy. Topics of the papers include: fuel utilization; agricultural technology; gasifiers; thermochemical conversions; silviculture; biomass boiler systems; harvesting biomass; future of the biomass industry; innovations in conversion technologies; and peat fuel enterprises in America. Separate abstracts have been prepared for 13 papers for inclusion in the Energy Data Base. (DMC)

19902 (DOE/ER/10546—T1) Solar energy storage via endothermic photochemical reactions. Final technical report. Wamser, C.C.; Olmsted, J.A. III. (California State Univ., Fullerton (USA)). 26 Dec 1983. Contract FG02-79ER10546. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006730.

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Research effort on this focused on two aspects of photochemical solar energy storage: the storage potential of photoisomerization reactions and studies of polymer-bound photosensitizers. The latter area has become the major focus of our research efforts, specifically the study of membrane-bound photosensitizers. The status of these studies at the termination of the grant are described below. Detailed results of the photoisomerization work have appeared in the literature, and a copy of that manuscript is included in this report.

19903 (DOE/ET/20544—T1) Photovoltaic mechanisms in polycrystalline thin-film solar cells. Final report, 28 September 1978-28 September 1979. Zanio, K. (Hughes Research Labs., Malibu, CA (USA)). Mar 1980. Contract AC01-78ET20544. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009522.

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Studies were undertaken to examine grain boundaries in polycrystalline material and apply these results to the development of thin-film solar cells using InP as the absorber layers. A model was developed which related material parameters to leakage currents in a thin-film polycrystalline p-n junction. In this model, the grain boundary was treated as a semiconductor with bandgap lower than that of the surrounding bulk. Since a leakage current at the grain boundary might decrease for a wider bandgap material, InGaP was considered and deposited by planar reactive deposition (PRD) on a single-crystal InP and lattice-matched GaAs. X-ray analysis and Hall measurements indicated that the quality of the epitaxy on GaAs was superior to that on InP, presumably due to a closer lattice match. Parallel etching studies to preferentially remove the grain boundaries showed that a 5HCl: $3HNO_3$: 4HF etch was highly selective in attacking the grain boundaries in bulk polycrystalline InP. Canyons with depths greater than 10 μm and widths on the order of 1 μm are the most common form of attack.

19904 (DOE/JPL/955392—2) Safety-related requirements for photovoltaic modules and arrays. Final report. Levins, A. (Underwriters Labs., Inc., Melville, NY (USA)). Mar 1984. Contract NAS-7-100-955392. 287p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84010158.

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Underwriters Laboratories has conducted a study to identify and develop safety requirements for photovoltaic module and panel designs and configurations for residential, intermediate, and large scale applications. Concepts for safety systems, where each system is a collection of subsystems which together address the total anticipated hazard situation, are described. Descriptions of hardware, and system usefulness and viability are included. This discussion of safety systems recognizes that there is little history on which to base the expected safety related performance of a photovoltaic system. A comparison of these systems, as against the provisions of the 1984 National Electrical Code covering photovoltaic systems is made. A discussion of the UL investigation of the photovoltaic module evaluated to the provisions of the Proposed UL Standard for Flat-Plate Photovoltaic Modules and Panels is included. Grounding systems, their basis and nature, and the advantages and disadvantages of each are described. The meaning of frame grounding, circuit grounding, and the type of circuit ground are covered. The development of the Standard for Flat-Plate Photovoltaic Modules and Panels has continued, and with both industry comment and a product submittal and listing, the Standard has been refined to a viable document allowing an objective safety review of photovoltaic modules and panels. How this document, and other UL documents would cover investigations of certain other photovoltaic system components is described.

19905 (DOE/JPL/955688—82/10) Development of an all-metal thick film cost effective metallization system for solar cells. Final report, May 1980-January 1983. Ross, B.; Parker, J. (Bernd Ross Associates, San Diego, CA (USA)). Dec 1983. Contract NAS-7-100-955688. 131p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84008241.

Properties of copper pastes did not reproduce earlier results in rheology and metallurgy. Electrodes made with pastes produced under the previous contract were analyzed and raw material characteristics were compared. A needle-like structure was observed on the earlier electroded solar cells, and was identified as eutectic copper-silicon. Experiments were conducted with variations in paste parameters, firing conditions, including gas ambients, furnace furniture, silicon surface and others to improve performance characteristics. Improved adhesion with copper pastes containing silver fluoride, as well as those containing fluorocarbon powder was obtained. Front contact experiments were done with silver fluoride activated pastes on bare silicon, silicon oxide and silicon nitride coated silicon wafers. Adhesion of pastes with AgF on silicon nitride coated wafers was good, but indications were that all cells were shunted and the conclusion was that these systems were unsuitable for front contacts. Experiments with aluminum back surfaces and screened contacts to that surface were begun. Low temperature firing tended to result in S shaped IV curves. This was attributed to a barrier formed at the silicon-copper interface. A cooperative experiment was initiated on the effect of heat-treatments in various atmospheres on the hydrogen profile of silicon surfaces. Contact theory was explored to determine the role of various parameters on tunneling and contact resistance. Data confirm that the presence of eutectic Al-Si additions are beneficial for low contact resistance and fill factors in back contacts. Copper pastes with different silver fluoride additions were utilized as front contacts at two temperatures. Data shows various degrees of shunting. Finally, an experiment was run with carbon monoxide gas used as the reducing ambient during firing.

19906 **(DOE/JPL/956046—83/9) Carbon, oxygen and their interaction with intrinsic point defects in solar silicon ribbon material. Annual report, September 1982-September 1983.** Goesele, U.; Ast, D.G. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). Oct 1983. Contract NAS-7-100-956046. 60p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009494.

This report first provides some background information on intrinsic point defects, and on carbon and oxygen in silicon in so far as it may be relevant for the efficiency of solar cells fabricated from EFG ribbon material. We discuss the co-precipitation of carbon and oxygen and especially of carbon and silicon self interstitials. A simple model for the electrical activity of carbon-self-interstitial agglomerates is presented. We assume that the self-interstitial content of these agglomerates determines their electrical activity and that both compressive stresses (high self-interstitial content) and tensile stresses (low self-interstitial content) give rise to electrical activity of the agglomerates. The self-interstitial content of these carbon-related agglomerates may be reduced by an appropriate high-temperature treatment and enhanced by a supersaturation of self-interstitials generated during formation of the p-n junction of solar cells. It is suggested that oxygen present in supersaturation in carbon-rich silicon may be induced to form SiO_2 precipitates by self-interstitials generated during phosphorus diffusion. It is proposed that the SiO_2-Si interface of the precipates gives rise to a continuum of donor states and that these interface states are responsible for at least part of the light-enhancement effects observed in oxygen containing EFG silicon after phosphorus diffusion.

19907 **(DOE/R7/01000—T1) Improved fuelwood harvesting and handling systems.** (Iowa Conservation Commission, Des Moines (USA)). 1983. Contract FG47-79R701000. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007808.

There exists a great deal of small diameter wood in the forest which is presently unutilized. Most hardwood forests would benefit greatly if thinnings and inprovement cuttings could be economically made in these smaller size classes. High speed firewood production may be within reach of any woodland owner who has a farm tractor. This paper describes a variety of equipment which can be used to greatly enhance the productivity of the farm tractor for woods use.

19908 **(DOE/R7/01213—T1) Evaluation of storability of a sugar producing biomass crop. Final report.** Posler, G.L.; Hill, N.S. (Kansas State Univ., Manhattan (USA). Dept. of Agronomy). 15 Feb 1983. Contract FG47-81R701213. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009761.

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A study was conducted during 1981-1982 at Kansas State University to determine sugar conservation in sweet sorghum biomass stored as silage. Rio, a disaccharide cultivar, and Dale, a monosaccharide cultivar, were grown at the Agronomy Research Center, Manhattan, Kansas on a Kohola silt loam, a cumulic hapludoll, fine-silty, mixed, mesic soil. Based on soil tests, initial soil fertility levels were 86 kg/ha nitrogen, 470 kg/ha potassium, and 78 kg/ha phosphorus, with a pH of 5.6. It is possible to conserve 100% of the sugars in sweet sorghum silages when acrylic acid is applied at a rate of 0.5% of the wet weight prior to ensiling the chopped crop. The cost of such an addition (assuming acrylic acid costs $.51 per pound in bulk) when the wet crop is 10% sugar is approximately $.41 per gallon of ethanol produced. If only 74% of the sugars are conserved using .25% acrylic acid, the cost would be $.172 per gallon of ethanol produced. We emphasize that this is the cost of the acid only and does not include the cost of special equipment for application or storage structures. The present feedstock cost of sweet sorghum for ethanol production is $1.14 to $1.16 per gallon (DOE 1979). Therefore the cost of producing ethanol by using preserved silage would be $1.41 to $1.57 per gallon plus equipment costs. This does not appear to be feasible in the immediate future but if crop production costs decrease to a projected cost of $.83 to $.91 per gallon of ethanol (DOE 1979) or if liquid fuel costs continue to increase, conservation of sugars using silage additive techniques may be promising. 22 references, 7 tables.

19909 **(FRNC-TH—1336) Heat and electric power generation by photovoltaic cells. Study, design and fabrication of a hybrid solar collector.** Assaf, C. (Lyon-1 Univ., 69 (France)). Oct 1981. 201p. (In French). NTIS (US Sales Only), PC A10. Order Number DE84751043.

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In the first chapter, some points about astronomy, solar radiation and the theory of the photovoltaic effect are recalled. The second part includes the description of the hybrid solar collector as also of the components that constitute the prototype collector. The choice of the components (photovoltaic cells, outer cover, spectrally selective solution, thermal insulation...) is discussed according to their ideal characteristics and the practical, or economic constraints. The three following chapters develop the theoretical study. An analytical model is first developed when the collector is operating, with any nature of materials or dimensions of the components. The differential equations system which has been obtained, has been adapted to the built prototype after some necessary approximations to solve it. The numerical method of the finite differences has been used. To solve the matricial equation which has been obtained, a computer has been used. The fifth chapter gives the results of this numerical solution; it gives interesting conclusions about the behavior of the collector in steady or transient conditions. Then, the experimental study is presented, the collector has been integrated in a complete installation; systematic measures have been done during an important number of days to get significant results. The theoretical behavior and the experimental results are then compared. Some comparisons with the performance of hybrid collectors now tested in foreign laboratories are briefly presented. Some possible applications of the hybrid collector are pointed out taking into account its performance, as also a short economic study of the profitability of an installation in which it would be integrated.

19910 **(NP—4770178) Utilization of plant residues and wastes in chemistry.** Schweers, W. (Arbeitsgemeinschaft fuer Rationalisierung des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). 1980. 20p. (In German). NTIS (US Sales Only), PC A02. Order Number DE84770178.

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Wood as raw material can only be economically used to produce chemical products when a wide palette of products using all wood components can be manufactured, i.e. ethanol from hexose, furfurol from pentose and phenols from lignin at the same time, or if lignin can be used otherwise maintaining its macromolecular structure.

19911 **(PB—84-137280) Fabrication of silicon prototype panels with one-dimensional concentration. Final report.** Van Overstraeten, R.; Mertens, R. (Commission of the European Communities, Luxembourg). 1984. 80p. (EUR—8217-EN). NTIS, PC E05/MF E05.

Effects of high doping levels (10 to the 17th power cu cm to 4 x 10 to the 19th power cu cm) in silicon and their influence on devices are discussed, e.g. frequency characteristics of bipolar trnsistors and integrated logic devices, as well as transport equations. Results of an experimental electrical measurement of bandgap narrowing in n-type substrates by measurement of hole current densities are reported; also those of diffusion lengths by IR spectral response.

19912 **(PB—84-137306) Theoretical study of alternative thin film solar cells. Final report.** Pauwels, H. (Commission of the European Communities, Luxembourg). 1984. 111p. (EUR—8157-EN). NTIS, PC E06/MF E06.

The investigation covers two main subjects:- (1) energy barriers and interface effects on the efficiency of heterojunction solar cells, and (2) a literature search on materials that would perform best in optimum structures. Work reported on point (1) includes the effect of tunnelling, the generation and recombination of charge carriers, as well as on the current-voltage characteristics of solar cells. After detailed studies on the best performing materials, subjects for future work were suggested, such as research into metal-

semi-conductor junctions. Appendices give relevant extracts from various publications.

19913 **(PB—84-138270) Improvement of the performance of a large diameter silicon solar cell. Final report.** Diguet, D. (Commission of the European Communities, Luxembourg). 1984. 53p. (EUR—8145-FR). NTIS, PC E04/MF E04.

A method of preparing large diameter solar cells has been developed to a stage where reproducible performances are obtained. While all the problems concerned with the intrinsic quality of the silicon used in the solar cells have not yet been solved, analytical methods have been developed for selecting the most suitable silicon samples prior to use. Studies concerned with the preparation of the substrate, deposition of the antireflection bed, and soldering of the connections are reported. Equipment for examining the solar cells is described.

19914 **(PB—84-138932) Development of single crystal CdTe-solar cells for terrestrial applications. Phase 2. Section 1. Part 1. Section 2. Final report.** Jaeger, H.; Fuessl, B.; Seipp, E. (Commission of the European Communities, Luxembourg). 1984. 170p. (EUR—8155-DE). NTIS, PC E08/MF E08.

Investigations of the system n-CdS/p-CdTe were successfully continued during the period covered by the report, i.e. the second half of 1978. Several p-CdTe crystals were grown. A phosphorus-doped crystal (K 13, with p = t x 10 to the 16th power/cu cm) proved to be of optimum suitability for solar cells.

19915 **(SAND—83-1932C) Grain boundary passivation kinetics for polycrystalline silicon.** Ginley, D.S.; Hellmer, R.P. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 17p. (CONF-840561—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009464.

From 17. IEEE photovoltaic specialists conference; Kissimmee, FL, USA (1 May 1984).

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The passivation of grain boundaries in polycrystalline silicon with monatomic hydrogen has demonstrated considerable potential for improving thin film and ribbon solar cell efficiencies. Very little is known of the chemistry and kinetics of this process. In this paper we demonstrate a kinetic model which describes both the time and depth dependence of the passivation process. The process can be viewed as a fast near surface diffusion (30 microns) coupled with a slower bulk diffusion of the atomic hydrogen which can subsequently react in a bimolecular fashion with boundary defect sites. The diffusion constants determined from the model agree very well with the few experimentally determined ones in the literature.

19916 **(SAND—83-7023) Polymeric web lens evaluation.** Cobb, S. Jr. (Minnesota Mining and Mfg. Co., St. Paul (USA). Optics Technology Center). Feb 1984. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010108.

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The feasibility of producing parquets of point focus fresnel lenses on a continuous thin polymeric web is described. The parquet produced consisted of 15 square lenses, each 6.7 in. on a side. Two 15 lens parquets were laminated to a heavier acrylic sheet for rigidity. The primary aim was the production of the parquet in thin form, with performance approaching that of compression molded lenses. The results demonstrated that a high degree of replication is possible, with performance nearly equal to the direct cut control lens.

19917 **(SERI/SP—281-2154) Biomass energy technology. Volume I. Executive summary. Annual technical progress report, FY 1982.** (Solar Energy Research Inst., Golden, CO (USA)). Dec 1983. Contract AC02-83CH10093. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84000084.

This report has been prepared in two volumes. Volume I is the Executive Summary. Volume II is the detailed annual report describing the Biomass Energy Technology (BET) program activities conducted during fiscal year 1982 (October 1, 1981 to September 30, 1982). Included are major research objectives and accomplishments as well as concise summaries of such research. This document represents the dedicated efforts of several national laboratories who are supported by a large number of university and private-sector research teams. This volume is an overview of the research funded by BET and is divided into three research areas: feedstock production, feedstock conversion, and crosscutting activities.

19918 **(SERI/SP—290-1448) Basic photovoltaic principles and methods.** Hersch, P.; Zweibel, K. (Solar Energy Research Inst., Golden, CO (USA)). Feb 1982. Contract AC02-77CH00178. 66p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007673.

This book presents a nonmathematical explanation of the theory and design of photovoltaic (PV) solar cells and systems. The basic elements of PV are introduced: the photovoltaic effect, physical aspects of solar cell efficiency, the typical single-crystal silicon solar cell, advances in single-crystal silicon solar cells. This is followed by the designs of systems constructed from individual cells, including possible constructions for putting cells together and the equipment needed for a practical producer of electrical energy. The future of PV is then discussed. (LEW)

19919 **Continuous culture for production.** Bull, A.T. (Univ. of Kent, Canterbury, England). pp 405-437 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

The stirred tank fermenter is still the most popular industrial reactor and culture volumes of about 300 m^3 and power inputs of about 4 KWm^{-3} appear to be maximum scale figures. The new generation of fermenters will be at least one order of magnitude larger in size, and alternatives to stirred tanks will be imperative; continuous-flow air-life loop reactors of the I.C.I. SCP and Deep-shaft waste treatment types are indicative of current thinking. The selection of a reactor system for a designated process will be influenced not only by the scale required but also by the interaction between the organism and the physical environment within which it grows.

19920 **Screening Prosopis (mesquite) species for biofuel production on semi-arid lands.** Felker, P. Washington, DC; Department of Energy (1981). 226p.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 19918

19921 **(BNL—34081) Photovoltaic-electrolyzer system transient simulation results.** Leigh, R.W.; Metz, P.D.; Michalek, K. (Brookhaven National Lab., Upton, NY (USA)). Dec 1983. Contract AC02-76CH00016. 10p. (CONF-840402—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010217.

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

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Brookhaven National Laboratory is developing an integrated test bed to illustrate advanced hydrogen technology. The first phase of this effort will investigate the use of solar energy to produce hydrogen from water via photovoltaic-powered electrolysis. A coordinated program of system testing, computer simulation, and economic analysis has been adopted to characterize and optimize the photovoltaic-electrolyzer system. This paper presents the initial transient simulation results. Innovative features of the modeling include the use of real weather data, detailed hourly modeling of the thermal characteristics of the PV array and of system control strategies, and examination of systems over a wide range of power and voltage ratings. The transient simulation system TRNSYS was used, incorporating existing, modified or new component subroutines as required. For directly coupled systems, we found the PV array voltage which maximizes hydrogen production to be quite near the nominal electrolyzer voltage for a wide range of PV array powers. The array voltage which maximizes excess electricity pro-

duction is slightly higher. The use of an ideal (100% efficient) maximum power tracking system provides only a six percent increase in annual hydrogen production. An examination of the effect of PV array tilt indicates, as expected, that annual hydrogen production is insensitive to tilt angle within +- 20° of latitude. Summer production greatly exceeds winter generation. Tilting the array, even to 90°, produces no significant increase in winter hydrogen production.

19922 **(DOE/R7/01164—T1) Use of photovoltaics to supply some lighting at the Lake Afton Public Observatory. Final technical report.** Unruh, H. Jr. (Wichita State Univ., KS (USA). Dept. of Physics). 1984. Contract FG47-80R701164. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010009.

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We have constructed a system for supplying electrical power, using photovoltaic cells, to a collection of observing stations near the observatory. The collection of nine observing stations are on a pad about 40' x 40' located about 60' from the observatory building. The observing stations hold small telescopes for students' use and require low level lighting for reading of instrumentation. It is this low level lighting that is supplied by the photovoltaic panel using battery electrical energy storage. The photovoltaic system was prepared for practical use during the first part of last June. Since then it has been used on most clear nights. The system has worked without problems.

19923 **(SAND—82-7147) Design of a photovoltaic central power station: flat-plate array.** (Martin Marietta Corp., Denver, CO (USA). Denver Aerospace). Feb 1984. Contract AC04-76DP00789. 252p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84008825.

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A design for a photovoltaic central power station using fixed flat-panel arrays has been developed. The 100 MW plant is assumed to be located adjacent to the Saguaro Power Station of Arizona Public Service. The design assumes high-efficiency photovoltaic modules using dendritic web cells. The modules are arranged in 5 MW subfields, each with its own power conditioning unit. The photovoltaic output is connected to the existing 115 kV utility switchyard. The site specific design allows detailed cost estimates for engineering, site preparation, and installation. Collector and power conditioning costs have been treated parametrically.

19924 **(SAND—82-7149) Design of a photovoltaic central power station.** (Martin Marietta Corp., Denver, CO (USA). Denver Aerospace). Feb 1984. Contract AC04-76DP00789. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009505.

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Photovoltaic central power station designs have been developed for both high-efficiency flat-panel arrays and two-axis tracking concentrator arrays. Both designs are based on a site adjacent to the Saguaro Power Station of Arizona Public Service. The plants are 100 MW each, made of 5 MW subfields. The site specific designs allow detailed cost estimate for site preparation, installation, and engineering. These designs are summarized and cost estimates analyzed. Provided also are recommendations for future work to reduce system cost for each plant design.

1407 Solar Thermal Power Systems

19925 **(DOE/SF/11676—T1) Preliminary design for solar repowering at Pioneer Mill Co., Ltd. Final report.** (Amfac Energy, Inc., Honolulu, HI (USA)). Nov 1983. Contract FC03-82SF11676. 490p. NTIS, PC A21/MF A01; 1; GPO Dep. Order Number DE84006459.

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This report describes a preliminary design for a solar repowering facility. The design addresss facilities and plant modifications for the addition of a solar central receiver system of Pioneer Mill Company, Ltd., an existing cogeneration facility near Lahaina, Maui, Hawaii. The sections included are: executive summary; introduction; existing plant description; repowered facility description; operation and performance; economic analysis; and development plan.

19926 **(EPRI-AP—3285-Vol.1) 10-MW(e) solar-thermal central-receiver pilot plant. Volume 1. Report on lessons learned. Final report.** Criner, D.E.; Gould, G.L.; Soderstrum, M.G.; Ege, H.D.; Wolfs, K.E. (Burns and McDonnell Engineering Co., Kansas City, MO (USA)). Oct 1983. 181p. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

The purpose of this study was to review the Solar One project and to identify, from an electric utility perspective, technical lessons learned from the project. These lessons pertain to the design, construction, and initial operation of Solar One. Areas studied include system design features, plant equipment, project organization, plant operations, and environmental impact. In reviewing the project, the study essentially adopted the perspective of an electric utility or its architect-engineer and focused upon those aspects of Solar One that would be of particular interest to such organizations. In addition to identifying lessons learned, a second task of the investigation was to prepare a bibliography of the technical reports and other documents for the Solar One project. Such a bibliography was prepared and published as part of Volume 2 of the final report for this study.

19927 **(NP—4770188) Solar thermal power generation.** (Bundesverband Solarenergie, Essen (Germany, F.R.)). 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770188.

This information brochure is published by the BSE (Bundesverband Solarenergie), an industrial association in which almost all the main manufacturers in the German solar technology industry are represented. Using selected examples, the characteristic features of various power plant concepts, namly the farm concept and the tower concept, and their plant design are presented. Economical, technological and thermodynamic aspects of both concepts are discussed and future prospects for the implementation of solar thermal power generating plants are given.

19928 **(SAND—82-7068/2) Environmental degradation of solar optical materials. Volume 2.** Kojima, C.J.; Smith, C.A. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Jan 1984. Contract AC04-76DP00789. 337p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84006505.

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Exposure of solar optical materials to use environments results in degradation of the materials. Degradation effects can be evaluated by measurements of the appropriate optical properties. In situ environmental exposure tests were conducted at two locations. Both reflecting and transmitting materials were evaluated for changes in optical properties due to environmental effects. These results were computerized along with information obtained from the literature survey summarized in Volume 1 of this report. The computerized data base was used for an analysis and correlation of degradation in optical properties' values with selected environmental test site parameters. Optical properties for reflecting and transmitting materials were investigated as well as differing exposure test techniques and optical properties measurement methods. Modeling of optical properties degradation was studied for various materials in the soiled condition and following a cleaning procedure.

1408 Ocean Energy Systems

19929 **(DOE/ET/20330—T1) Experimental investigation of the onset of nucleate boiling in ammonia flowing inside a large-diameter smooth aluminum tube.** Pandolfini, P.P.; Keirsey, J.L.; Rice, J.L. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 15 Mar 1978. Contract AB01-76ET20330. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84006677.

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A series of experiments has been completed which investigates the occurrence of the Onset of Nucleate Boiling (ONB) in ammonia flowing inside a large-diameter aluminum tube. The tube simulates one pass of a multipass evaporator which is proposed by APL for use in a low-cost Ocean Thermal Energy Conversion (OTEC) plant-ship heat exchanger. The 25 tests covered mass flows of 0.7 to 1.5 lbm/sec, heat fluxes of 1100 to 3600 Btu/hr-ft^2 and levels of subcooling of the ammonia of 4 to 20°F. Observations of the onset of nucleate boiling (ONB) were judged to occur at several flow conditions where the local heat transfer coefficients were measured to be much higher than the all-liquid flow coefficient; in some cases, the presence of vapor dryout at the upstream part of the tube also indicated ONB. The observations were compared with predictions made by the correlation method of Bergles and Rohsenow (as modified by Frost and Dzakowic) and indications are that this correlation predicts the occurrence of ONB very well. The conclusion that this prediction method be used in design work with smooth tubes is made in addition to the recommendation that similar ONB tests be performed with an enhanced surface.

19930 **(JHU/APL-AEO—81-122) Testing of a shell-less, folded-aluminum-tube heat exchanger core unit as an evaporator and a condenser.** Pandolfini, P.P.; Keirsey, J.L.; Funk, J.A. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). Dec 1981. Contract AI01-77ET20342. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84005601.

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A full-scale portion (core unit of 1-MW/sub t/ size) of a shelless, folded-aluminum-tube heat exchanger, conceived by JHU/APL as an integral part of an Ocean Thermal Energy Conversion (OTEC) power system, was tested first as an evaporator and then as a condenser. The overall heat transfer coefficients (U's) were 480 and 435 Btu/hr-ft^2-°F for the evaporator and condenser, respectively, at the conditions yielding the optimal trade-off between the U's and the ammonia pumping power for a full-scale unit. In both modes it operated stably with essentially equal ammonia distribution among the tubes. The water-side pressure drop was as predicted for the optimal water velocity of 2.5 ft/s through the minimum gaps between tubes in the staggered tube array. The evaporator ammonia-side pressure drop was lower than predicted; however, because of the stratified flow that apparently exists, the condenser ammonia pressure drop was higher than predicted. The computer simulation for closed-cycle power system performance was revised to reflect the test results. Full-scale heat exchanger modules designed for 5 MW/sub e/ net power at an ocean water temperture difference of 42°F would have 69 vertical rows of seven nested, folded tubes each -1932 tubes total of 3-in.-OD Alclad (7072) 3004 aluminum alloy, each folded into 25 horizontal passes. These heat exchangers, cleanable by vertical translation of ultrasonic cleaning devices between tube rows, offer a viable, low-cost option for OTEC use. Prior work on this concept is summarized, and recommendations for at-sea tests are presented.

19931 **(JHU/APL-OQR—82-1) Ocean thermal energy. Quarterly report, January-March 1982.** (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1982. Contract AI01-77ET20342. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84005671.

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This quarterly report summarizes work of the following tasks as of March 31, 1982: OTEC pilot plant conceptual design review; OTEC methanol; review of electrolyzer development programs and requirements; financial and legal considerations in OTEC implementation; potential Navy sites for GEOTEC systems; hybrid geothermal-OTEC power plants: single-cycle performance estimates; and supervision of testing of pneumatic wave energy conversion system.

19932 **(JHU/APL-OQR—82-2) Ocean thermal energy. Quarterly report, April-June 1982.** (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1982. Contract AI01-77ET20342. 30p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84003369.

This quarterly report includes summaries of the following tasks: (1) OTEC pilot plant conceptual design review; (2) OTEC methanol; (3) management decision requirements for OTEC construction; (4) hybrid geothermal - OTEC (GEOTEC) power plant performance estimates; and (5) supervision of testing of pneumatic wave energy conversion system.

19933 **(JHU/APL-OQR—82-3) Ocean energy systems. Quarterly report, July-September 1982.** (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1982. Contract AI01-77ET20342. 36p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84005603.

This quarterly report summarizes work on the following tasks as of September 30, 1982: (1) OTEC pilot plant conceptual design review; (2) OTEC methanol; (3) financial and legal considerations in OTEC implementation; (4) GEOTEC resource exploration at Adak, Alaska, and Lualualei, Hawaii; (5) preliminary GEOTEC plant cost estimates; and (6) supervision of testing of pneumatic wave energy conversion system.

19934 **(JHU/APL-OQR—82-4) Ocean energy systems. Quarterly report, October-December 1982.** (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1982. Contract AI01-77ET20342. 28p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84005602.

Research progress is reported on developing Ocean Thermal Energy Conversion (OTEC) systems that will provide synthetic fuels (e.g., methanol), energy-intensive products such as ammonia (for fertilizers and chemicals), and aluminum. The work also includes assessment and design concepts for hybrid plants, such as geothermal-OTEC (GEOTEC) plants. Another effort that began in the spring of 1982 is a technical advisory role to DOE with respect to their management of the conceptual design activity of the two industry teams that are designing offshore OTEC pilot plants that could deliver power to Oahu, Hawaii. In addition, a program is underway in which tests of a different kind of ocean-energy device, a turbine that is air-driven as a result of wave action in a chamber, are being planned. This Quarterly Report summarizes the work on the various tasks as of 31 December 1982.

19935 **(JHU/APL-OQR—83-1) Ocean energy systems. Quarterly report, January-March 1983.** (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1983. Contract AI01-77ET20342. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84005200.

Progress is reported on the development of Ocean Thermal Energy Conversion (OTEC) systems that will provide synthetic fuels (e.g., methanol), energy-intensive products such as ammonia (for fertilizers and chemicals), and aluminum. The work also includes assessment and design concepts for hybrid plants, such as geothermal-OTEC (GEOTEC) plants. Another effort that began in the spring of 1982 is a technical advisory role to DOE with respect to their management of the conceptual and preliminary design activity of industry teams that are designing a shelf-mounted offshore OTEC pilot plant that could deliver power to Oahu, Hawaii. In addition, a program is underway to evaluate and test the Pneumatic Wave-Energy Conversion System (PWECS), an ocean-energy device consisting of a turbine that is air-driven as a result of wave action in a chamber. This Quarterly Report summarizes the work on the various tasks as of 31 March 1983.

19936 **(PB—83-223586) Ocean Thermal Energy Conversion (OTEC) cold water pipe three-dimensional design methodology. Volume 2. Users manual.** (TRW Systems and Energy, Redondo Beach, CA (USA)). Jun 1982. Contract AI01-77ET20396. 238p. (DOE/NOAA/OTEC—100-2). NTIS, PC A11/MF A01.

This report describes a computer program developed by TRW for use in performing three-dimensional dynamic analysis of Ocean Thermal Energy Conversion (OTEC) cold water pipe (CWP) systems. The program, in FORTRAN IV-H language, was prepared in the time domain in order to permit the inclusion of non-linearities and other effects that cannot be included at all or can, at best, be approximated by frequency domain programs. These effects include velocity-squared drag, finite angles, parametric excitation, and out-of-roundness. Shear deformation and rotary inertia effects are also included. The detailed report is documented in two volumes: Volume I - Technical Manual and Volume II -

Users Manual. Volume I presents the technical basis for the analytical formulation and solution procedure. Volume II gives a detailed description of the computer program and complete operating instructions. A brief synopsis of these detailed volumes is contained in the Executive Summary document. The source deck for the program has been delivered to the National Oceanic and Atmospheric Administration (NCAA) and is available from that agency. Access to the compiled (binary) deck for use on the CDC CYBERNET system is likewise available by arrangement with NOAA.

19937 **(USGS-OFR—82-468-A) Geologic report for the O'OTEC site off Kahe Point, Oahu, Hawaii.** Normark, W.R.; Chase, T.E.; Wilde, P.; Hampton, M.A.; Gutmacher, C.E.; Seekins, B.A.; Johnson, K.H. (Geological Survey, Menlo Park, CA (USA); Lawrence Berkeley Lab., CA (USA)). Apr 1982. Contract W-7405-ENG-48. 23p. S; 3; GPO Dep. Order Number DE84005038.

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The O'OTEC geologic survey provides the following points of information concerning development of the OTEC facilities of the Kahe Point: (1) the 1000 m isobath lies in the landward half of a gently sloping (10 to 20% grade) plateau that is generally sediment covered. The plateau extends as much as 15 km from the coast to a water depth of 1600 m. Although the plateau sediment cover locally displays a morphology and internal structure indicative of submarine sliding, or other types of mass movement, the age of movement or extent of internal disruption is not known. Thus, the geotechnical studies (Part B of this report by Winters and Lee) on the sediments recovered provide the only direct evaluation of the engineering properties of this sediment cover. (2) The more gently sloping plateau is separated from the shelf and coastal area by a steeper (30 to 90% grade) narrow slope that appears relatively free of sediment cover resolvable by acoustic profiling south of Maili Point. (3) The distribution of sediment type as mapped with the acoustic-reflection profiles does not show a simple relation to volcanic bedrock relief. The bathymetry basically reflects the volcanic surface because the resolvable sediment cover is generally less than 35 m.

19938 **(USGS-OFR—82-468B) Evaluation of geotechnical properties and slope stability of a calcareous ooze on the south-west slope off Oahu, Hawaii.** Winters, W.J.; Lee, H.J. (Geological Survey, Menlo Park, CA (USA)). May 1982. Contract AC03-76SF00098. 276p. NTIS, PC A13; 3; GPO Dep. Order Number DE84005041.

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The Oahu Ocean Thermal Energy Conversion (O'OTEC) site is located offshore and to the southwest of Kahe Point, Oahu on a 3° to more than 40° slope that extends to depths greater than 2700 m. The site is being considered as the location for an ocean thermal energy conversion plant that will use the temperature difference between surface and deep (1000m) water in the production of usable energy. This specific area was selected because of accessibility to existing onshore power distribution systems and favorable climatic and oceanic conditions. A geological and geophysical survey was conducted from which gravity coring samples suitable for geotechnical analysis was produced. These four core samples ranging in length from 1.75 to 5.50 m, were tested within a framework of analysis that was developed to evaluate regional offshore slope stability. The results are suitable for roughly specifying the regional variation in geotechnical properties for use in the preliminary design of anchors and foundations for the O'OTEC project. The results of consolidation, triaxial and index property testing conducted primarily to define a profile of undrained shear strength variation with depth are presented. Other parameters derived as by-products of this testing are tabulated as well. In the discussion section these results are applied to a regional slope stability analysis and tentative conclusions regarding the general stability of the area are presented.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 20346, 20366, 20371, 20374, 20379, 20384

19939 **(CONF-8011206—1) Integrated use of solar panels and a waste heat scavenger. Progress report.** Jarrell, J.H.; Miller, B.R.; Smathers, W.M. Jr. (Georgia Univ., Athens (USA). Dept. of Agricultural Economics). 1980. Contract FG44-80R410160. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84000779.

From Energy saving equipment and stray voltage on dairy farms conference; Monroe, GA, USA (14 Nov 1980).

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The objectives of this project were to: (1) install energy measurement devices on commercially available solar collectors and a heat scavenger attached to the dairy refrigeration system; and (2) make the results of the demonstration available to other dairy farmers. The objectives have been accomplished. Measurement devices have been installed and are currently establishing a data base on system performance. A demonstration for dairy farmers was sponsored by the Agricultural Economics Department and the Agricultural Engineering Extension Department of the University of Georgia. The demonstration and associated program was held in November of 1980 at Monroe, Georgia which is near the demonstration dairy. A tour of the dairy followed presentation of energy related topics. About 60 farmers attended this program. A copy of the program and a summary of experience with the system are attached.

19940 (CONF-8105242—, pp vp) **Passive solar energy utilization (abridged version).** Koch, H. 1981. (In German). NTIS (US Sales Only), PC A03/MF A01.

From Annual meeting of the German and Austrian institutes of constructional biology: humanisation of living and building construction; Woergl, Austria (8 May 1981).

The passive utilization of solar energy through aimed architectural measures is an inexpensive and economical alternative of energy utilization. It is essentially dependent on the heat storage capacity of the interior parts of a building on the one hand and the functional separation of a sun shade installed without for the hot season and an anti-dazzle protection installed within for the winter on the other hand. In 10 points the measures for effective passive utilization of solar energy are synoptically presented and briefly substantiated.

19941 (CONF-8105242—, pp vp) **Solar water heaters (abridged version).** Bruck, M. 1981. (In German). NTIS (US Sales Only), PC A03/MF A01.

From Annual meeting of the German and Austrian institutes of constructional biology: humanisation of living and building construction; Woergl, Austria (8 May 1981).

Among the various technologies for utilizing solar energy the methods to produce low-temperature heat are not only the most highly developed but offer also the most interesting uses of solar energy. Useful heat can be produced both directly via collectors and indirectly through heat pumps. Moreover both systems can be combined. Collector systems for heat production are more closely examined. For these, flat plate collectors are to be considered in the first place. The decisive factor for the choice of a collector for a specific use is its thermal efficiency. Possibilities to improve existing collector systems for industrial water heating are pointed out. The paper concludes with some aspects of the economic efficiency of such collectors.

19942 **(DOE/CS/30344—2) Courtyard Commons retail addition. Phase I. Final design documentation.** (Lau (Ron), Santa Cruz, CA (USA)). 25 Apr 1981. Contract FC02-80CS30344. 117p. NTIS, PC A06; 3; GPO Dep. Order Number DE84006570.

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The project consists of a retail addition to an existing cluster of buildings located on the main commercial street in Santa Cruz, California. The existing complex is formed by two wings of one-story buildings enclosing an open courtyard now used for circula-

tion, a coffee shop seating area, a flower stand, and access to four retail stores. The program calls for an addition of new retail space above the existing buildings constructed of eight inch concrete blocks. In order to provide for the year around use of the courtyard, the program also calls for a flexible glass cover which could be removed during the sunny warm summer days. The main requirements of the program finally, are to develop an energy efficient and cost effective design which uses natural light at its full potential for both the courtyard and interior spaces. This report includes sections of the following: overview of final design; unavailable solar design information; incremental passive design cost, energy performance analysis and results; economic analysis and results; architectural compatibility; NBSGLD output and documentation; and design development drawings.

19943 **(DOE/NBM—4006922) Installation guidelines for solar DHW systems in one- and two-family dwellings.** (Franklin Research Center, Philadelphia, PA (USA)). 1983. 109p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84006922.

This report is written to help the professional installation contractor and the skilled homeowner avoid simple mistakes made in the installation of solar water heating systems. The guidelines also contain pointers for maintenance and a checklist to be consulted when doing the actual installation. All of the procedures outlined in the report comply with HUD's Intermediate Minimum Property Standards Supplement, Solar Heating and Domestic Hot Water Systems, Volume 5. The guidelines are compatible with most national building codes.

19944 **(DOE/R7/01010—T1) Appropriate technology small grants program. Final report.** McColl, R.W. (McColl (Robert W.), Lawrence, KS (USA)). 1984. Contract FG47-79R701010. 61p. NTIS, PC A04; 3; GPO Dep. Order Number DE84007756.

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The object of this project was to build three distinct solar heating systems using different media for heat storage and testing the value of blowers or natural convection in the heating of an individual dwelling. The three water-based storage systems were: (1) aluminum cans recycled from discarded soft drink and beer; (2) fifty-gallon drums painted black and silver; and (3) large water bags of silicon-permeated fiberglass. Experiences gained from the first two systems are reported; the third system was yet to be completed.

19945 **(DOE/R7/01203—T1) Retrofit active solar hot water system. Final report.** (Drapac (Michael J.), Cedar Rapids, IA (USA)). Dec 1983. Contract FG47-81R701203. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84006076.

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The purpose of this activity was to investigate methods to develop an active solar hot water heating system specifically designed for retrofit on existing homes. To meet that end, two-thirds of the system design is complete - an exterior plumbing system and an external heat exchanger for a hot water tank. Also, the active solar collector has been designed with a parabolic trough reflector and an active tracking system. However, the fabrication and installation of three systems on existing homes is scheduled to be completed as planned.

19946 **(NP—4900687) Application of solar thermal energy in potash refining. Summary.** Mancini, T.R.; Mulholland, G.P.; Wilson, D.B. (New Mexico State Univ., Las Cruces (USA)). Jun 1982. 19p. NTIS, PC A02/MF A01. Order Number DE84900687.

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Potash refining operations are first discussed. Low-temperature applications of solar thermal technology such as flat plate collectors, solar ponds, and concentrating collectors are examined for the potash refining units operations of flotation, vacuum crystallization, and drying.

19947 **(SOLAR/1118—83/14) Solar-energy-system performance evaluation update: Stevens Home, Rancho Sante Fe, California, May 1982-April 1983.** Kendall, P.W. (Vitro Corp., Silver Spring, MD (USA)). 1983. Contract AC01-79CS30027. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84004357.

The Stevens Home solar site is a single family residence in Rancho Santa Fe, California. The active solar energy system is designed to supply 70% of the hot water load at this site. It is equipped with: 68 square feet of flat-plate collectors manufactured by Revere; a 120-gallon solar preheat water tank located in an unheated garage, and an auxiliary gas-fired (propane), 40-gallon domestic hot water heater. The system and subsystem performance for the 12-month monitoring period is presented.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 19909, 19916, 19928

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

19948 **(PB—84-137330) Technical and economic feasibility of low-energy geothermal sources in Europe. Final report.** (Commission of the European Communities, Luxembourg). 1984. 293p. (EUR—8241-EN). NTIS, PC E12/MF E12.

Important potential geothermal resources exist in the EEC; while only Italy possesses assured high-energy sources, almost all of the other countries possess potential low-energy sources which are worth evaluating. An attempt is made to demonstrate in general the technical and economic feasibility of exploiting these resources within the range of 30C and 150C, since this has already been done in France over the last ten years, and more recently has been initiated in Italy, Belgium, Germany, Great Britain, and Denmark. The subjects dealt with in detail include: the inventory of potential resources, project planning, the utilization of geothermal low-energy sources and the modelling of production costs.

19949 **(PB—84-137348) Technical and economic feasibility of the low energy geothermal sources in Europe. Appendices. Final report.** (Commission of the European Communities, Luxembourg). 1984. 367p. (EUR—8241/11-FR). NTIS, PC E13/MF E13.

This is Part 2 of an earlier report and comprises 14 appendices of technical matter covering the determination of hydrogeological characteristics in a geothermal system, provisional technical programs for such things as drilling and well-tubing, influence of climatic data, heat exchangers and pumps, cost of production and injection pumps, transportation of geothermal water, examples of heat balances in industries such as the malting, brewing, dairy and tannery industries, and the utilization of a geothermal source in the mineral industry. Detailed reports are given for each of the systems already in existence in France. The present geothermal situation in Italy is reviewed together with projects and forecasts of use.

19950 **(USGS-CIRC—892) Assessment of low-temperature geothermal resources of the United States - 1982.** Reed, M.J. (ed.). (Geological Survey, Menlo Park, CA (USA)). 1983. Contract AI01-77ET28383. 77p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84007193.

Separate abstracts were prepared for six papers. (MHR)

19951 (USGS-CIRC—892, pp 1-8) **Introduction.** Reed, M.J. 1983. NTIS, PC A05/MF A01.

In Assessment of low-temperature geothermal resources of the United States - 1982.

The geothermal-resource assessment presented here is the first quantitative estimation of the thermal energy recoverable from low-temperature (less than 90°C) geothermal systems within the United States. This assessment, based on data available through April 1982, includes estimates of accessible resource base (geothermal energy in the ground), resource (energy that might be recover-

able at the surface), and beneficial heat (energy that might be usable in a specific application). The minimum temperature for low-temperature geothermal resources was defined as 10°C above the mean annual air temperature at the surface and increasing by 25°C/km with depth. Systematic variations in heat flow and temperature gradient permitted the division of the United States into western, central, and eastern regions; within each of these regions, the low-temperature geothermal resources were divided into hydrothermal-convection and conduction-dominated systems. Quantitative estimates were made for the geothermal energy available in undiscovered as well as identified systems, and the results are tabulated by region, State, and geologic province. Identified low-temperature geothermal systems in the United States contain an accessible resource base of 27 x 10^{21} J, a resource of 87 x 10^{18}J, and a beneficial heat of 41 GW/sub t/ for 30 years. Undiscovered low-temperature geothermal systems are estimated to contain an additional accessible resource base of 7.2 x 10^{21}J, a resource of 66 x 10^{18}J, and a beneficial heat of 30 GW/sub t/ for 30 years.

19952 (USGS-CIRC—892, pp 9-16) **Regional heat flow and temperature gradients.** Nathenson, M.; Guffanti, M.; Sass, J.H.; Munroe, R.J. 1983. NTIS, PC A05/MF A01.

In Assessment of low-temperature geothermal resources of the United States - 1982.

To assess the potential for low-temperature geothermal resources in regional conductive thermal environments, a knowledge of temperature gradients to depths of about 2 km is required. Regional variations in temperature gradient, which reflect corresponding regional variations in heat flow, thermal conductivity, or both, result in some uncertainties in the derivation of deep thermal-gradient data from near-surface (100-250-m depth) heat flows. A contour map of regional heat flow in the conterminous United States shows that heat flow in the West is generally higher than in the East. A temperature-gradient map, based on data from 240 drill holes generally deeper than 600 m, indicates the same sort of first-order variation in geothermal-resource potential as does the heat-flow map, although there also are some important differences between these two maps. Large areas are without data on both maps, but either map can be used to identify promising geothermal-resource areas or areas where more reconnaissance work is needed.

19953 (USGS-CIRC—892, pp 17-30) **Methods for assessing low-temperature geothermal resources.** Sorey, M.L.; Nathenson, M.; Smith, C. 1983. NTIS, PC A05/MF A01.

In Assessment of low-temperature geothermal resources of the United States - 1982.

In this assessment, mean values for the thermal energy stored in each identified low-temperature reservoir were obtained from estimates of triangular probability densities for the reservoir area, thickness, and temperature. Mean values of the thermal energy recoverable at the surface depend on estimates of the number of production wells each reservoir can support over a period of 30 years. An assumed development plan, with evenly spaced wells producing at 31.5 L/s at a maximum drawdown of 152 m, was used to generate curves that relate reservoir area and hydrologic properties to the optimum well spacing. The optimum well spacing is shown to increase with reservoir area but to be relatively insensitive o the length of the development period and the fraction of time during a given period that fluid production actually occurs. Finally, estimates of the amount of recoverable energy that can be used in applications at the surface were obtained as a function of reservoir temperature.

19954 (USGS-CIRC—892, pp 31-50) **Low-temperature geothermal resources in the western United States.** Mariner, R.H.; Brook, C.A.; Reed, M.J.; Bliss, J.D.; Rapport, A.L.; Lieb, R.J. 1983. NTIS, PC A05/MF A01.

In Assessment of low-temperature geothermal resources of the United States - 1982.

Most of the 1084 low-temperature (less than 90°C) geothermal systems identified in the Western United States are characterized by hydrothermal convection; conduction-dominated systems are identified only in the Columbia Plateaus (8 systems) and the Salton Trough (1 system). The identified accessible resource base for all low-temperature geothermal systems in the Western United States is about 310 x 10^{18}J. The resource associated with these identified thermal reservoirs is about 31 x 10^{18}J, corresponding to a beneficial heat of 13.7 GW/sub J//, for 30 years. Hydrothermal-convection systems account for 96 percent of this resource; conduction-dominated systems contain approximately a third of the identified accessible resource base, and about 1 percent of this energy can be extracted as a resource under the proposed development plan. The undiscovered accessible resource base is estimated at 480 x 10^{18}J; thus, the total accessible resource base available from identified and undiscovered low-temperature geothermal systems in the Western United States is 790 x 10^{18}J.

19955 (USGS-CIRC—892, pp 51-65) **Low-temperature geothermal resources in the central and eastern United States.** Sorey, M.L.; Reed, M.J.; Foley, D.; Renner, J.L. 1983. NTIS, PC A05/MF A01.

In Assessment of low-temperature geothermal resources of the United States - 1982.

Identified low-temperature (less than 90°C) geothermal resources in the Central and Eastern United States occur primarily in regional aquifers within sedimentary basins in the Great Plains and in aquifers beneath the Gulf and Atlantic Coastal Plains. Additional resources occur in hydrothermal-convection systems associated with thermal springs in the Wyoming Basins and Ouachita geologic provinces and in the Appalachian Mountains. The total accessible resource base for identified low-temperature geothermal reservoirs in the Central and Eastern United States is estimated at 27 x 10^{21}J. The total identified resource is estimated at 55 x 10^{18}J, from which 28 GW/sub t/ for 30 years of beneficial heat could be obtained. Estimates of the total undiscovered accessible resource base, resource, and beneficial heat are 6.7 x 10^{21}J, 18 x 10^{18}J, and 9.2 GW/sub t/ for 30 years, respectively.

19956 (USGS-CIRC—892, pp 67-73) **Summary.** Reed, M.J. 1983. NTIS, PC A05/MF A01.

In Assessment of low-temperature geothermal resources of the United States - 1982.

NONE

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 19961

19957 **(LA—9966-HDR) Petrographic analysis and correlation of volcanic rocks in Bostic 1-A well near Mountain Home, Idaho.** Arney, B.H.; Gardner, J.N.; Belluomini, S.G. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 53p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84010239.

Detailed examination of volcanic rock cuttings from the Bostic 1-A well near Mountain Home, Idaho, provides data that correlate the stratigraphy of the well with the regional stratigraphy of the western Snake River Plain. The Bostic 1-A well penetrates basalt of the Middle Pleistocene Bruneau Formation and underlying sedimentary rocks of the Upper Pliocene Glenns Ferry Formation. Basalt underlying the Glenns Ferry Formation is most likely Banbury Basalt of Middle Pliocene age or Banbury equivalent. A 350-ft interval of felsic volcanics is then intersected above another 600 ft of basalt. The well bottoms in altered felsic volcanics. The lowest 600 ft of basalt flows has not been correlated with any basalt observed on the surface. From the established stratigraphy of the region, and from petrographic evidence, the silicic volcanic rocks occurring both above and below the lowermost basalts in the well are probably lower Pliocene Idavada Volcanics. North of the well, in the Mt. Bennett Hills, Idavada Volcanics overlie crystalline rocks of the Idaho batholith. No estimate of depth to plutonic bedrock can be made from the well data alone. Stratigraphic comparisons suggest as little as 0.2 to 0.3 km more of Idavada lie beneath the Bostic 1-A well. Results of geophysical studies suggest additional basalt lies beneath the Bostic 1-A rather than granitic rocks of the batholith.

1503 Geothermal Exploration And Exploration Technology

19958 (SAND—84-7109) Evaluation of borehole electromagnetic and seismic detection of fractures. Chang, H.T.; Suhler, S.A.; Owen, T.E. (Sandia National Labs., Albuquerque, NM (USA); Southwest Research Inst., San Antonio, TX (USA). Dept. of Geosciences). Feb 1984. Contract AC04-76DP00789. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009507.

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Experiments were conducted to establish the feasibility of downhole high-frequency techniques for location of fractures in the vicinity of boreholes. An existing flame-cut slot in granite was filled with salt water to simulate a brine-filled fracture. The first method used an electromagnetic wave at 30 to 300 MHz, vhf frequencies. A transmitter consisting of a phased dual-dipole array arranged to provide a directional signal toward the fracture was installed in a borehole opposite the fracture. A receiver was also located in the same borehole. The radar returns from the simulated fracture were detectable in boreholes located at distances of up to 12 meters from the fracture. These results indicate for the first time the feasibility of a downhole vhf radar for use in a single borehole for detection of fractures located away from the borehole. Similar experiments were also conducted using seismic waves at 4.5 to 6 KHz. The transmitter and the receiver in this case were located in separate boreholes. During this experiment, reflections from the slot were obtained only with the transducers oriented for shear wave illumination and detection. These results suggest that a high-frequency shear wave can also be used to detect fractures away from a borehole.

1504 Legal And Institutional Aspects

19959 (DOE/ET/28495—T1) Managing for success: developing and exploiting international opportunities in geothermal energy. (Futures Group, Glastonbury, CT (USA)). Jul 1981. Contract AC01-77ET28495. 58p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009520.

This study is designed to assist the Division of Geothermal Energy (DGE) in deciding what kind of strategy it wants and needs in order to make its international effort as cost-effective and appropriate as possible. The purpose of this study is to construct a logic base on which DGE can, in turn, establish its own strategy for international cooperation, and can begin to plan for necessary organization, procedural and policy reforms. This report will constitute a set of decision guidelines for DGE to consider in determining the nature of future strategy-related reforms. Each chapter asks, and then answers, the question on which it is centered as follows: (1) what are the deficiencies in DGE's current approach; (2) what should an international strategy for DGE ensure; (3) how can an international strategy for DGE be manifested; (4) which strategic model presents the best opportunity now; and (5) how can the recommended alternative be achieved.

1505 Economic And Financial Aspects

19960 (DOE/ET/27125—T2-Vol.6) Sperry Low Temperature Geothermal Conversion System, Phase I and Phase II. Final report. Volume VI. Economic studies. Harvey, C. (Sperry Research Center, Sudbury, MA (USA)). 1983. Contract AC03-78ET27125. 80p. (SRC-CR—83-43-Vol.6). NTIS, PC A05/MF A01; GPO Dep. Order Number DE84008039.

The basic thrust of the studies represented was to compare the overall economics of the Gravity Head system with that of optimized conventional binary generating plants. The study is site-specific to the East Mesa geothermal reservoir. It begins with an analysis of optimum individual well production based on the known characteristics of the reservoir. The limiting factors at East Mesa are reservoir drawdown and maximum practical brine pump impeller setting depth. Using the 1300 gpm, 360° F resource as a starting point, detailed cost estimates and performance calculations were made for the Gravity Head and various conventional alternative well-head systems. The most cost effective of the conventional alternatives was found to be a 700 psi cycle using R114 as the working fluid (actually optimized at 682 psi). The study is in two parts. In Part I, emphasis is placed on the economic sensitivities of the compared systems to variations in capital cost, O and M cost, avoided energy inflation rates, and brine cost. In Part II, a somewhat more rigorous attempt is made to derive the actual economic performance of the systems under more realistic circumstances with contingencies, cost penalties, and multiple-unit developments added.

1506 Environmental Aspects And Waste Disposal

19961 Practicality and sophistication in subsidence modeling for geothermal systems. Dershowitz, W. (Golder Associates, Seattle, WA); Miller, I. pp 137-142 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—).

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

This paper presents research conducted by the authors and their colleagues at Golder Associates to evaluate the available models for prediction of geothermal subsidence, and to suggest new directions and approaches. The most obvious strategy for evaluation of subsidence models is to perform case study analyses for particular models and sites, and compare the accuracy of predictions. This approach is, however, inadequate for present purposes as failures in prediction can be due to many factors other than model error, including mismatching of model and cases, and inadequate data. Therefore, the study includes both case studies and case independent proficiency assessments of different models.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 19931, 19932, 19933, 19934, 19935, 19964

19962 (DOE/ET/27125—T2-Vol.3) Sperry Low Temperature Geothermal Conversion System, Phase I and Phase II. Final report. Volume III. Systems description. Matthews, H.B. (Sperry Research Center, Sudbury, MA (USA)). 1984. Contract AC03-78ET27125. 84p. (SRC-CR—83-40-Vol.3). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008042.

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The major fraction of hydrothermal resources that have the prospect of being economically useful for the generation of electricity are in the 300°F to 425°F temperature range. Cost-effective conversion of the geothermal energy to electricity requires the conception and reduction to practice of new ideas to improve conversion efficiency, enhance brine flow, reduce plant costs, increase plant availability, and shorten the time between investment and return. The problems addressed during past activities are those inherent in the geothermal environment, in the binary fluid cycle, in the difficulty of efficiently converting the energy of a low-temperature resource, and in geothermal economics. Explained in detail in this document, some of these problems are: the energy expended by the down-hole pump; the difficulty in designing reliable down-hole equipment; fouling of heat-exchanger surfaces by geothermal fluids; the unavailability of condenser cooling water at most geothermal sites; the large portion of the available energy used by the feed pump in a binary system; the pinch effect - a loss in available energy in transferring heat from water to an organic fluid; flow losses in fluids that carry only a small amount of useful energy to begin with; high heat-exchanger costs - the lower the temperature interval of the cycle, the higher the heat exchanger costs in $/kW (actually, more than inversely proportional); the complexity and cost of the many auxiliary elements of proposed geothermal plants; and the unfortunate cash flow vs. investment curve caused by the many years of investment required to bring a field into production before any income is realized.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 19958

19963 (DOE/ET/27125—T4-Vol.2) System component compatibility and R-114 stability. Volume II. Final report. Goodson, J.E. Jr.; Nowicki, D.F.; Thibeau, R.J.; Toekes, B.; Wilson, D.P. (Sperry Research Center, Sudbury, MA (USA)). 1981. Contract AC03-78ET27125. 119p. (SRC-CR—81-75-Vol.2). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84008037.

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High temperature stability-compatibility studies of R-114 refrigerant and proposed Sperry Geothermal System components were performed. The R-114 refrigerant, geothermal brine, and ten lubricants were tested in the presence of five metals, eight metal alloys, two ceramics, two iron oxides, and twenty-two elastomers in several combinations, temperature levels, and durations. Compatibility experiments of elastomers and non-elastomeric sealants in aqueous solutions and lubricating oils were performed. The development of the downwell packer necessitated the completion of an elastomer formulation development program. The system component material selection and specifications for the pump system are given. The seal material selection for the stand-alone turbine-pump-unit is presented in detail.

19964 (PNL—5042) Report on design, construction, and testing of CO_2 breakout system for geothermal brines. Robertus, R.J.; Shannon, D.W.; Sullivan, R.G. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84010241.

A skid mounted test facility has been built for determining conditions at which CO_2 flashes from geothermal brines. The system has been checked and operated at one geothermal plant. It performed as designed. The equipment is designed to operate at temperatures and pressures typical of wells near Heber, California. (Nominally 180°C and 300 to 500 psig). It has heat exchangers which can cool the brine to less than 70°C. (The cooling water is recirculated after being cooled by a forced air heat exchanger). Breakout pressures can be determined for any temperature between 70°C and wellhead temperature. An adjustable orifice provides final control on pressure required to initiate flashing. The orifice is at the bottom of a sight glass. A light beam shines through the sight glass and focuses on a photoelectric cell. The presence of bubbles scatters light and decreases the output of the cell. Results using the cell were more reproducible than those using the naked eye. Results from one test show a smooth curve over the temperature range 75°C to 165°C. Agreement between the experimental values and calculated ones is discussed.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 21154

19965 Effects of water-saturation on strength and ductility of three igneous rocks at effective pressures to 50 mpa and temperatures to partial melting. Bauer, S.J.; Friedman, M.; Handin, J. (Texas A and M Univ., College Station). pp 79-84 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—). Contract AS05-79ER10361.

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

Energy extraction from the geothermal regime in and above buried magma-chambers requires that rocks be drillable (brittle or semi-brittle) and boreholes be stable to depths of 10 km, at temperatures to partial melting, and in a natural or manmade aqueous environment. Critical are the short-term strengths and ductilities that would govern during and immediately after drilling, and the longer-term, time-dependent response, that would influence the stability of a borehole over the multi-year life-expectancy of a geothermal well.

16 Wave Energy Converters

REFER ALSO TO CITATION(S) 19931, 19932, 19933, 19934, 19935

17 WIND ENERGY

REFER ALSO TO CITATION(S) 20346, 20354

1706 Wind Energy Engineering

19966 (DOE/BP—195) Wind energy assessment studies in the Goodnoe Hills and Cape Blanco areas. Final progress report, October 1981-September 1982. Baker, R.W.; Wade, J.E.; Persson, P.O.G. (Oregon State Univ., Corvallis (USA). Dept. of Atmospheric Science). Nov 1983. Contract AC79-80BP17530. 146p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84010087.

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The details of two studies to better define the wind power potential at two potential wind power development areas are given. The sites are located along the southern Oregon coast (Cape Blanco) and in the Columbia River Gorge (Goodnoe Hills/Juniper Point). The variation of wind with height is found as well as the effect of removing trees on the strength and vertical profile of wind in the Cape Blanco area. (LEW)

19967 (DOE/R7/01176—T1) Development of a low-stress wind turbine. Final technical report. Traudt, J.E. (Windcatcher Co., Omaha, NE (USA)). Mar 1982. Contract FG47-80R701176. 15p. NTIS, PC A02; 3; GPO Dep. Order Number DE84010093.

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A low-stress wind turbine rotor is developed in which, in high winds, the turbine blades turn endwise to the wind (coning). The prototype uses an articulated rotor coupled with a simple centrifugal force mechanical actuation system for blade pitch control. The wind turbine generator uses a two-bladed articulated rotor. The root section of each blade incorporates a hinge to allow the blade to rotate perpendicular to the rotor's plane of rotation. Each airfoil is free to feather rotate about its longitudinal axis. The system's atmospheric testing is described. (LEW)

19968 (DOE/R7/01207—T1) Wind-driven heat pump system. Final report. Franklin, R.L. (Westmar Coll., Le Mars, IA (USA)). 30 Sep 1983. Contract FG47-81R701207. 10p. NTIS, PC A02; 3; GPO Dep. Order Number DE84010097.

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The purpose of the project funded by this grant was to develop, build and test a wind driven heat pump system suitable for providing space heat and low temperature process heat such as that needed for crop drying. In addition, a supplementary project was approved which used funds saved by building rather than purchasing the heat storage tanks for the installation of an earth loop heat source. The first task has been completed in its entirety. Data in this report will show that the system is capable of both heating and cooling a residence in moderate wind regimes. The earth loop is in place and all fitting has been completed for testing as the heating season approaches. As it is impossible to demonstrate that the earth loop will heat the house in winter without the experience of cold weather for some time, this testing must wait. This report will address the various systems one at a time. Correlation of data for the complete system will follow for that portion of the testing which has been done.

19969 (DOE/R7/01219—T1) On-site analysis to assess the feasibility of wind power. Olson, R.E. (Olson (Richard E.), Colby, KS (USA)). 1984. Contract FG47-81R701219. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009762.

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Due to the lack of appropriate wind data in the rural environs of northwest Kansas, a mobile on-site analysis unit to assess the feasibility of wind power was proposed and subsequently constructed. The trailer, with a 45' telescoping tower, is equipped with an recording anemometer and windvane. The mobile unit consists of a two wheeled, steel trailer with mounting hardware to support the 45' tower. Guy wires are necessary, at all heights, to withstand the high wind gusts often encountered on the Great Plains. When a complete alternative energy analysis is desired, a weather shelter is available to be mounted on the trailer to house the additional monitoring instruments.

19970 **(DOE/R7/01221—T1) Passive yaw damping of a teetered rotor versus delta-3 angle values.** Bryant, P.J. (Missouri Univ., Kansas City (USA). Dept. of Physics). 1984. Contract FG47-81R701221. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009758.

A series of preliminary experiments has been completed to delineate the combinations of passive cyclic pitching conditions which are favorable. The conditions surveyed have included: upwind and downwind modes of operation; a wide range of δ_3 angle settings, from $+70^0$ to -70^0; rotor angular speeds from 300 to 750 rpm and the resulting ranges of teeter angles and yaw rates. Negative settings of the δ_3 angle and large positive δ_3 values caused pronounced instabilities for both upwind and downwind modes. With δ_3 angle settings from 0^0 to 45^0 the teetered rotor in the downwind mode ran at a continuous yaw angle to the free stream wind. Midrange δ_3 angle values for an upwind, tailvane stabilized, rotor were favorable.

19971 **(DOE/R7/01221—T2) Design construction and test procedures for HAWT rotors.** Bryant, P.J.; Niu, H.P. (Missouri Univ., Kansas City (USA)). 1984. Contract FG47-81R701221. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009756.

This paper presents a review of some procedures by which a Horizontal Axis Wind Turbine (HAWT) may be evaluated. A research project to analyze the dynamic stability of HAWT rotors is described. Controlled Velocity Test procedures (CVT) are presented. The use of a small pickup truck as a CVT vehicle is illustrated. Calibration data for the power output of a Small Wind Energy Conversion System (SWECS), as derived by the CVT method, are presented. The use of a shaker table and accelerometers to determine the natural resonant frequencies of a rotor is described. In summary, some basic procedures for design, construction and evaluation of small HAWT rotors for research purposes is the subject of this paper.

19972 **(DOE/R7/01221—T3) Operation and calibration of the Wincharger 450 model SWECS.** Bryant, P.J.; Boeh, M. (Missouri Univ., Kansas City (USA)). 1984. Contract FG47-81R701221. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009757.

This paper presents an analysis of the operation of the new 450 model Wincharger. Assembly, testing, output power calibrations and other operational parameters are presented. Techniques of testing are described, including the use of a pickup truck for Controlled Velocity Tests (CVT). The measured output power was just above the rated values when only 12 volts was applied to the generator field. When a separate and constant 15 volt field was applied the output ranged from 46 watts for a 10 mi/h wind speed to 1146 watts for 35 mi/h. At the rated 25 mi/h speed an output of 774 watts was obtained by tuning a resistive load. These values are much greater than the ratings for this unit. However, it is being tested here with a separate field supply and without a voltage regulator.

19973 **(DOE/R7/01221—T4) Optimization of wind turbine design for SWECS. Final report, October 1, 1981-October 1, 1983.** Bryant, P.J. (Bryant (Paul J.), Prairie Village, KS (USA)). 1983. Contract FG47-81R701221. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009759.

Current research to optimize wind turbine designs centers on the most important parameter, the useful lifetime of the rotor assembly. The original cost and maintenance of this portion of a wind machine has traditionally been the most important factor in cost effectiveness. Thus, the effort under this project has concentrated on a rotor design which promises to extend the lifetime of the full rotor assembly. That design improvement includes the integration of a teetered rotor hub and a delta-3 angle. This design concept was proven in helicopter and rotor craft applications. The adaptation to wind turbines has been the primary task of this appropriate technology utilization project. Test rotors, incorporating the teetering hub, delta-3 angle design, have been constructed and tested. The research model provides a full range of settings for a complete evaluation of the relevant parameters; e.g. the delta-3 angle is variable from $+70$ to -70^0, the rotor position may be varied fore and aft of the teeter axis, the teeter spring rate is continuously variable, also the teeter and yaw stops are adjustable. The use of a dc generator permits the rotor to change angular speed with wind speed. The lack of a yaw drive allows the rotor to display its own passive yawing rates and accommodation factors as a function of delta-3 angle, rotor-axis position, and teeter spring rate settings. Test rotors and wind machines were assembled for data collection. The equipment was designed specifically for research, i.e., with a range of variables so that the relevant parameters could be evaluated. The controlled velocity testing (CVI) method was adapted for rapid, inexpensive data collection. This technique replaces the more expensive wind tunnel tests. By mounting the test machine and wind turbine above a small truck the testing process was facilitated. The adaptation of the CVT technique expedited this project and set an example for future low cost use of the CVT technique.

19974 **(NP—4900987) SWECS industry in the US.** Nelson, V. (West Texas State Univ., Canyon (USA). Alternative Energy Inst.). Jan 1984. 10p. NTIS, PC A02/MF A01. Order Number DE84900987.

The small wind energy conversion systems (SWECS) industry in the United States is reviewed from its early beginnings in the 1930's, through the federally supported work, to present uses of wind power. (LEW)

19975 **(SAND—83-1909C) Modeling stochastic wind loads on vertical axis wind turbines.** Veers, P.S. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-8405127—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007888.

From 25. AIAA/ASME/ASCE/AHE structures, structural dynamics and materials conference; Palm Springs, CA, USA (14 May 1984).

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The Vertical Axis Wind Turbine (VAWT) is a machine which extracts energy from the wind. Since random turbulence is always present, the effect of this turbulence on the wind turbine fatigue life must be evaluated. This problem is approached by numerically simulating the turbulence and calculating, in the time domain, the aerodynamic loads on the turbine blades. These loads are reduced to the form of power and cross spectral densities which can be used in standard linear structural analysis codes. The relative importance of the turbulence on blade loads is determined.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 19608, 19671, 19889, 20390

19976 **(BMFT-FB-T—83-265) Measurement and investigations of the energy balance of a cogeneration power station with multi-engine drive in commercial use.** Jensch, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1983. 150p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750727.

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Extensive measurements were conducted between 1. Sept. 1979 and 31. Aug. 1981 at the multi-engine power station at Heidenheim. The object of the investigation was to analyse the operation and energy performance of cogeneration power plants in

practical use. The results obtained serve as a basis for optimisation in the field of development, design, planning, dimensioning, monitoring, service and maintenance of the single components, units and entire plant and their compatibility with existing supply systems. Moreover, the knowledge on mechanisms and interdependences provide a reliable source of information on both operation economy and energy efficiency.

19977 **(DOE/CS/02849—T1) Coal conversion universe.** (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). 1 Sep 1977. Contract AC01-78CS02849. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009455.

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19978 **(EPRI-EL—3358) Stator-coil wedge-tightness detector. Final report.** Neeley, V.I. (VinTek, Inc., Richland, WA (USA)). Feb 1984. 42p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

In recent years a significant increase in generator failures has been identified with insulation damage caused by vibration due to loose or improperly installed stator slot wedges. In response to this problem, this project was initiated to develop a prototype wedge tightness inspection instrument which has been successfully accomplished. The hand-held, portable instrument detects the natural vibration resonance of a wedge and contacting probe. Differences in the vibration amplitude and center frequency of the resonance allow discrimination between wedges which are tight and properly installed and those that are loose, jammed or improperly installed. A small vibrator in the probe head is driven through a frequency band that brackets the tight wedge resonance. A force gauge, in the head, responds to the induced vibration of wedge and probe, and presents a signal whose amplitude and phase are monitored to detect the resonance parameters. Background information, together with the instrument design, field and demonstration tests and recommendations for the technology transfer and commercialization of the instrumentation are covered here.

19979 **(EPRI-NP—3311) Condensate polishing at Plant Bowen.** Friedman, K.A.; Siegwarth, D.P.; Sawochka, S.G.; McNea, D.A.; Suhonen, C.H. (NWT Corp., San Jose, CA (USA)). Feb 1984. 82p. EPRI, Research Reports Center (RRC), Box 50490, Palo Alto, CA 94303.

Condensate polisher system design and operation were evaluated at the fosssil-fueled Plant Bowen of Georgia Power Company relative to the ability of the polishers to achieve an effluent chemical quality consistent with PWR Steam Generator Owners Group Chemistry Guidelines. Polishers regenerated employing the Seprex and Ammonex processes were evaluated during normal plant operation and during periods of simulated condenser inleakage. Although polisher effluent quality was acceptable relative to boiler corrosion control at Plant Bowen, it was inconsistent with that required for recirculating PWR steam generators. Polisher effluent quality was reasonably consistent with requirements for PWR once-through steam generator systems. High polisher cation to anion resin equivalence ratios (3.4 to 1), and insufficiently rapid anion resin kinetics were the major reasons for the observed non-optimum polisher performance.

19980 **(EPRI-NP—3341) Metallurgical evaluation of keyway cracking in low-pressure turbine disks. Final report.** Burghard, H.C. Jr. (Southwest Research Inst., San Antonio, TX (USA)). Jan 1984. 96p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

A metallurgical evaluation of keyway cracking in the rotor discs of large LP steam turbines was performed. Three particular cases of the development of major keyway cracks in LP turbine discs at two nuclear steam electric generating stations were investigated. The overall objectives of the investigation were to characterize the disc material, establish the nature and extent of the keyway cracks and identify the cracking mechanism. Metallographic and fractographic examinations established that the cracking was predominantly intergranular and that significant corrosive attack had occurred within the keyways. It was also determined that the composition, mechanical properties and microstructure were normal for quenched and tempered NiCrMoV alloy steels and that the cracking was not associated with any inherent materials defect or abnormality. The identified the cracking mechanism as intergranular stress corrosion cracking (IGSCC). It is concluded that the keyway cracks developed as the result of the combined effects of the inherent IGSCC susceptibility of NiCrMoV alloy steels, the operating stresses, and environmental conditions encountered within large LP steam turbines.

19981 **Finding the weak links in power plant availability.** Cordova, A.H.; Weiss, J. *EPRI (Electric Power Research Institute) Journal;* 8: No. 12, 26-30(Dec 1983).

Doubling the reliability for a given component may or may not have a significant effect on overall unit availability. An inexpensive, easy-to-run computer model can isolate critical components and predict the impact of component changes and modifications. 4 references, 3 figures, 1 table.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 19637, 19643, 19644

19982 **(DOE/MC/16049—1558-Vol.1) Hot-gas cleanup system model development. Volume I. Final report.** Ushimaru, K.; Bennett, A.; Bekowies, P.J. (Flow Industries, Inc., Kent, WA (USA). Research and Technology Div.). Nov 1982. Contract AC21-81MC16049. 154p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84003090.

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This two-volume report summarizes the state of the art in performance modeling of advanced high-temperature, high-pressure (HTHP) gas cleanup devices. Volume I contains the culmination of the research effort carried over the past 12 months and is a summary of research achievements. Volume II is the user's manual for the computer programs developed under the present research project. In this volume, Section 2 presents background information on pressurized, fluidized-bed combustion concepts, a description of the role of the advanced gas cleanup systems, and a list of advanced gas cleanup systems that are currently in development under DOE sponsorship. Section 3 describes the methodology for the software architecture that forms the basis of the well-disciplined and structured computer programs developed under the present project. Section 4 reviews the fundamental theories that are important in analyzing the cleanup performance of HTHP gas filters. Section 5 discusses the effect of alkali agents in HTHP gas cleanup. Section 6 evaluates the advanced HTHP gas cleanup models based on their mathematical integrity, availability of supporting data, and the likelihood of commercialization. As a result of the evaluation procedure detailed in Section 6, five performance models were chosen to be incorporated into the overall system simulation code, ASPEN. These five models (the electrocyclone, ceramic bag filter, moving granular bed filter, electrostatic granular bed filter, and electrostatic precipitator) are described in Section 7. The method of cost projection for these five models is discussed in Section 8. The supporting data and validation of the computer codes are presented in Section 9, and finally the conclusions and recommendations for the HTHP gas cleanup system model development are given in Section 10. 72 references, 19 figures, 25 tables.

19983 **(DOE/MC/16049—1558-Vol.2) Hot-gas cleanup system model development. Volume II. Final report.** Ushimaru, K.; Bennett, A.; Bekowies, P.J. (Flow Industries, Inc., Kent, WA (USA). Research and Technology Div.). Nov 1982. Contract AC21-81MC16049. 82p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84003091.

Under Contract to the Department of Energy (DOE) through the Morgantown Energy Technology Center (METC), Flow Industries, Inc., has developed computer models to simulate the physical performance of five hot-gas cleanup devices for pressurized, fluidized-bed combustion (PFBC), combined-cycle power plants. Separate cost models have also been developed to estimate the cost of each device. The work leading to the development of these models is described in Volume I of this report. This volume contains the user's manuals for both the physical and cost models. The manuals for the physical models are given first followed by those for the cost models. Each manual is a complete and separate

document. The model names and devices and their respective subroutine names are: (1) Moving Granular Bed Filter by Combustion Power Company, USRCGB, QFCOST; (2) Ceramic Bag Filter by Acurex, USRACB, QDCOST; (3) Electrostatic Granular Bed Filter by General Electric, USRGGB, QACOST; (4) Electrostatic Precipitator by Research Cottrell, USRCEP, QECOST; and (5) Electrocyclone by General Electric, USRGCY, QBCOST.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 20572

19984 **Construction and start-up program evaluation by an independent source.** Allen, J.E. (Sargent & Lundy 55 E. Monroe Street Chicago, IL 60603). *Transactions of the American Nuclear Society;* **45**: 529-530(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19985 **Analytical chemsitry support to operating nuclear plants by Central Laboratory.** Law, J.J.; Brown, W.D.; McDowell, J.M. (Carolina Power and Light Co., 336 Fayetteville Street, P.O. Box 1551, Raleigh, NC 27602). *Transactions of the American Nuclear Society;* **45**: 639(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19986 **Rebuilding general administrative procedures: A quality experience.** Brey, H.L.; Jackson, J.P. (Public Service of Colorado, Denver, CO 80217). *Transactions of the American Nuclear Society;* **45**: 519-522(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19987 **Optimization of plant performance.** Gerken, W.W. (Nuclear Startup Services, Inc., 2245 S. State Street, P.O. Box 1368, Ann Arbor, MI 48106). *Transactions of the American Nuclear Society;* **45**: 527-528(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19988 **Lessons learned in nuclear power project management.** Schmidt, R. (International Atomic Energy Agency, P.O. Box 100 A-1400, Vienna). *Transactions of the American Nuclear Society;* **45**: 519(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19989 **Nuclear plant life extension: A comprehensive approach to plant improvements.** Marriott, P.W. (General Electric Company, Nuclear Energy Division, 175 Curtner Avenue, San Jose, CA 95125). *Transactions of the American Nuclear Society;* **45**: 563(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19990 **Commonwealth Edison's station control room engineer program.** Turbak, M.S. (Commonwealth Edison Co., P.O. Box 767, Chicago, IL 60609). *Transactions of the American Nuclear Society;* **45**: 635-636(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 20019, 20050, 20147, 20153, 20157, 20166, 20167, 20182, 20208, 20209, 20216, 20218, 20223, 20225, 20253, 20263, 20270, 20285, 20291, 20299

19991 **(EPRI-NP—2106) Core design and operating data for Cycles 2 and 3 of Hatch 1.** Holloway, G.L.; Fawks, J.E.; Crawford, B.W. (General Electric Co., San Jose, CA (USA). Nuclear Engineering Div.). Feb 1984. 129p. EPRI, Research Report Center, Box 50490, Palo Alto, CA 94303.

Purpose is to provide reference quality data for use in the qualification of reactor core analysis methods and to provide the basis for the assessment of the irradiation environment up to and including the end of Cycle 3 gamma scan. The design data includes fuel assembly description, core component arrangements, control rod descriptions, and core loading patterns. Operating data is compiled for selected steady-state operating points during Cycles 2 and 3. Data listed for each state point include core average burnup, thermal power, pressure, inlet subcooling, control configuration, and axial in-core detector readings where available.

19992 **(EPRI-NP—2107) Comparisons of simulated process computer calculations with gamma scan measurements at Hatch 1 at end of cycle 3. Final report.** Shiraishi, L.M.; Thompson, J.E. (General Electric Co., San Jose, CA (USA). Nuclear Engineering Div.). Mar 1984. 149p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

Gamma scan data at Hatch 1 were recorded at the end of cycle 3. These data are compared to bundle and nodal peaking factors derived from simulated Process Computer calculations of nine reactor state conditions near cycle shutdown. Comparisons were made for 128 bundles measured at 12 evenly spaced axial locations, representing more than a full octant of the core.

19993 **(UCID—20036) Technical evaluation report on the monitoring of electric power to the reactor protection system for the Vermont Yankee Nuclear Power Station (Docket No. 50-271).** Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 16 Mar 1984. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006573.

This report documents the technical evaluation of the monitoring of electric power to the reactor protection system (RPS) at the Vermont Yankee Nuclear Power Station. The evaluation is to determine if the proposed design modification will protect the RPS from abnormal voltage and frequency conditions which could be supplied from the power supplies and will meet certain requirements set forth by the Nuclear Regulatory Commission. The proposed design modifications will protect the RPS from sustained abnormal voltage and frequency conditions from the supplying sources.

19994 **Development of reload core licensing capability at TVA.** Robertson, J.D. (Tennessee Valley Authority 109 United Bank Building Chattanooga, TN 37401). *Transactions of the American Nuclear Society;* **45**: 511-512(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19995 **An ultrasonic level and temperature sensor for power reactor applications.** Dress, W.B.; Miller, G.N. (Oak Ridge National Laboratory Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **45**: 866-867(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19996 **Vermont Yankee stability tests during cycle 8.** Sandoz, S.A.; Chen, S.F. (General Electric Company, Nuclear Energy Division, 175 Curtner Avenue, San Jose, CA 95125). *Transactions of the American Nuclear Society;* **45**: 754-755(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19997 **Validation of BWR core modelling at TVA.** Keys, T.A. (Tennessee Valley Authority, 109 United Bank Building, Chattanooga, TN 37401). *Transactions of the American Nuclear Society;* **45**: 735-736(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19998 **Long Island Lighting Company, experience in validation of core models.** Weader, R.J.; Branco, M.M. (Long Island Lighting Company, 175 E. Old Country Road, Hicksville, NY 11801). *Transactions of the American Nuclear Society;* **45**: 741-742(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19999 **Reactor operation using heavy gadolinium loadings.** Lundberg, S. (Sydkraft AB S-217 01 Malmoe). *Transactions of the American Nuclear Society;* **45**: 738-739(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20000 **BWR operating experience with axially two-zoned fuel core.** Nishimura, A.; Aoki, T.; Ozawa, M.; Umegaki, K.; Yokomi, M. (Hitachi Ltd., 3-1-1 Saiwai-cho, Hitachi-shi Ibaraki 317). *Transactions of the American Nuclear Society;* **45**: 743-745(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20001 **Thermodynamic justification for halogen PCI failure of LWR fuel rods.** Kohli, R. (Battelle Columbus Laboratories, 505 King Avenue, Columbus, OH 43201). *Transactions of the American Nuclear Society;* **45**: 276-277(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20002 **Structure of high-burnup fuel zircaloy cladding.** Chung, H.M. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 285-286(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20003 **The EPRI viewpoint on materials regulation for light water reactors.** Stahlkop, K.E. (Electric Power Research Institute, 3412 Hillview Avenue, P.O. Box 10412, Palo Alto, CA 94303). *Transactions of the American Nuclear Society;* **45**: 298(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20004 **Radionuclide and filter demineralizer behavior in a boiling water reactor.** Duce, S.W.; Mandler, J.W. (EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **45**: 617-618(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20005 **The shift technical advisor at Monticello nuclear generating plant.** Nolan, L.L. (Northern State Power Co., Monticello Nuclear Generating Plant, Old Highway, Monticello, MN 55362). *Transactions of the American Nuclear Society;* **45**: 632-633(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20006 **Point Beach Nuclear plant duty technical advisor implementation and arrangement.** Reed, G. (Wisconsin Electric Power Co., 6610 Nuclear Road, Two Rivers, WI 54241). *Transactions of the American Nuclear Society;* **45**: 634-635(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 19803, 19804, 19979, 19980, 20001, 20002, 20003, 20051, 20148, 20151, 20152, 20155, 20157, 20165, 20167, 20168, 20169, 20170, 20175, 20211, 20212, 20213, 20214, 20215, 20217, 20219, 20220, 20221, 20224, 20230, 20233, 20244, 20251, 20253, 20271, 20273, 20274, 20275, 20276, 20277, 20298, 20300, 20301

20007 **(DOE/ET/34019—3) Development of a reactor coolant pump monitoring and diagnostic system. Progress report, June 1982-July 1983.** Morris, D.J.; Sommerfield, G.A. (Toledo Edison Co., OH (USA); Babcock and Wilcox Co., Lynchburg, VA (USA)). Dec 1983. Contract AC02-79ET34019. 37p. (BAW—1806). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010228.

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The quality of operating data has been insufficient to allow proper evaluation of theoretical reactor coolant (RC) pump seal failure mechanisms. The RC pump monitoring and diagnostic system being developed and installed at Toledo Edison's Davis-Besse Nuclear Power Station will examine the relationship between seal failures and three other variables: The rotordynamic behavior of the pump shaft and related components, the internal conditions and performance of the seals, and the plant or pump operating environment (controlled by the plant operator). Interrelationships between these areas will be developed during the data collection task, scheduled to begin in October 1983 (for a full fuel cycle at Davis-Besse). This report describes system software and hardware development, testing, and installation work performed during this period. Also described is a parallel effort being conducted by a B & W/ Byron Jackson/Utility group to improve pump seal performance.

20008 **(EPRI-NP—3302) Data acquisition-reduction system for chemical cleaning processes for nuclear steam generators.** Cartwright, R.J.; Jevec, J.M. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). Feb 1984. 155p. EPRI, Research Reports Center (RRC), Box 50490, Palo Alto, CA 94303.

A software package has been developed for use in conjunction with the MINC computer system to handle data acquisition, on-line evaluation, and off-line reduction for chemical cleaning demonstration tests. Such tests are being conducted as part of an overall effort to develop a process to effectively use chemical cleaning to remove corrosion products from the secondary side of nuclear steam generators. The computer/software system provides an improved quality and quantity of data for use in evaluating chemical cleaning process development.

20009 **(EPRI-NP—3394-CCM-Vol.1) TRANSG-01: a computer code for transient analysis of nuclear steam generators. Volume 1. Theory and mathematical formulation.** Lee, J.C.; Akcasu, A.Z.; Duderstadt, J.J.; Crump, M.W.; Fortino, R. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). Jan 1984. 138p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

In the present volume of the TRANSG-01 code report, a detailed derivation of the extended implicit continuous-fluid Eulerian (EICE) formulation is presented. A description of the slip flow model for representing two-phase flow on the secondary side is also given. The recirculation flow model, steam table data, and heat transfer correlations are also presented in this volume.

20010 (EPRI-NP—3394-CCM-Vol.2) TRANSG-01: a computer code for transient analysis of nuclear steam generators. Volume 2. Coding description. Martin, W.R.; Lee, J.C.; Ward, M.E.; Methnani, M.M.; Lee, S.C. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). Jan 1984. 58p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

Volume II of the report describes specific steam generator models incorporated in the TRANSG-01 code and the overall code structure. Flow charts illustrating the numerical solution technique and description of the subroutines are included.

20011 (EPRI-NP—3394-CCM-Vol.3) TRANSG-01: a computer code for transient analysis of nuclear steam generators. Volume 3. User's manual. Martin, W.R.; Lee, J.C.; Ward, M.E.; Methnani, M.M.; Lee, S.C. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). Jan 1984. 139p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report presents a detailed description of models that have been developed for the transient simulation of light water reactor steam generators. Description of the TRANSG-01 input file structure both for steady-state and transient steam generator calculations is presented in this volume. Output of the code is also described in detail, and sample input and output files are included in this volume.

20012 (EPRI-NP—3394-CCM-Vol.4) TRANSG-01: a computer code for transient analysis of nuclear steam generators. Volume 4. Applications. Lee, J.C.; Crump, M.W. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). Jan 1984. 66p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

Results of the TRANSG-01 calculations simulating the relevant steam generator test data or plant performance data are presented in this volume. Parametric studies testing the sensitivity of various parameters in the TRANSG-01 model are also included.

20013 (EPRI-NP—3432) PWR radiation fields through 1982. Durkosh, D.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.). Feb 1984. 510p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

To determine the factors which influence the buildup of radiation fields at pressurized water reactor (PWRs), a broad-based set of radiation field data is required. To address this need, the Standard Radiation Monitoring Program (SRMP) was established in 1977. As one part of the EPRI program, shutdown radiation field measurements are performed at standardized locations in and around components of the reactor coolant system of Westinghouse-designed PWRs. This report represents a compilation and presentation of radiation field data obtained from this program up through December 1982. In addition, Westinghouse files were reviewed to collect additional data taken at similar locations prior to the formation of the SRMP. As a result, radiation field data from 36 nuclear power plants are presented in this report.

20014 (INR—544/9) Relation between the nuclear plant power generation and the feed water temperature. Zmyslowski, A. (Institute of Nuclear Research, Warsaw (Poland)). Jul 1964. 8p. (In Polish). NTIS (US Sales Only), PC A02. Order Number DE84901005.

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In this paper the relation between the power generation and the feed water temperature in the pressurized water reactor plant is discussed. The method of calculating the optimal feed water temperature for the plant working on the saturated steam is given.

20015 (JAERI-M—82-202) Shielding experiments for evaluating a shielding safety evaluation code system to spent fuel processing facilities, (2). Experiments for the assessment on source geometry of PWR spent fuel assemblies. Tanaka, Shun-ichi; Sakamoto, Yukio; Yamaji, Akio. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 55p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700780.

Experiments to assess the source geometry approximation technique were performed based on the experimental plan to confirm the reliability of a shielding safety evaluation code system and data libraries. The present experiments is to take the data by which the analytical procedures can be confirmed on the approximation of the source geometry of spent fuel assemblies. For the purposes, four kinds of experiment were made using three spent fuel assemblies of the PWR with different irradiation histories, that is three experiments for each assembly and an experiment using altogether those assemblies. The distributions of gamma-ray exposure dose rate, $^{238}U(n, f)$ and $^{232}Th(n, f)$ reaction rates to neutrons were measured around the fuel assemblies set in a spent fuel pond. The strong dependency of neutron intensity was found on the burn-up of the fuel assemblies in the comparison with that of gamma rays. A multiplication of neutrons was also recognized in the experiment using three assemblies. This report gives the data of experimental conditions and detector characteristics necessary for the analysis by a shielding computer code as well as the detail of measured data.

20016 (NUREG/CR—3561) Eddy current round robin test on laboratory produced intergranular stress corrosion cracked Inconel steam generator tubes. Bickford, R.L.; Clark, R.A.; Doctor, P.G.; Kjarma, H.E.; LoPresti, C.A. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-65RL01830. 132p. (PNL—4695). NTIS (US Sales Only), PC A07/MF A01 - GPO $5.00; GPO Dep. Order Number DE84007291.

This report provides the results of an eddy current round robin test conducted on Inconel 600 steam generator tubing specimens with laboratory induced IGSCC. This test was an attempt to establish IGSCC in Inconel steam generator tubing. The participants were permitted to use any available eddy current method and were not limited to probes or methods that are or could be used in commercial primary side in-service inspection. Areas covered in this report include production of the specimens, defect characterizations by the participating teams, data from the subsequent destructive metallographic analysis of the specimens and a statistical evaluation of the results per team and between teams.

20017 Summary of NRC requirements and its research studies on reactor water level measurement. Hon, A.L.M.; Kondic, N.N.; Phillips, L.E. (U.S. Nuclear Regulatory Commission Washington, DC 20555). *Transactions of the American Nuclear Society;* **45**: 865-866(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20018 The application of volume-weighted skew-upward differencing to thermal and fluid mixing in the cold leg and downcomer of a PWR. Chen, F.F.; Chen, B.C.J.; Domanus, H.M.; Lyczkowski, R.W.; Niao, C.C.; Sha, W.T. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 850-852(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20019 Radionuclide inventories in extended burnup LWR fuels. Wilson, W.B.; England, T.R.; LaBauve, J. (Los Alamos National Laboratory P.O. Box 1663 Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **45**: 485-487(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 20052, 20171, 20172

20020 **(GEFR—00681) Gas-Cooled Thermal Reactor Program. Semiannual technical progress report, April 1, 1983-September 30, 1983.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Dec 1983. Contract AC03-80ET34034. 354p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84009041.

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An assessment of the HTGR opportunities from the year 2000 through 2045 was the principal activity on the Market Definition Task (WBS 03). Within the Plant Technology (WBS 13) task, there were activities to develop analytical methods for investigation of Coolant Transport Behavior and to define methods and criteria for High Temperature Structural Engineering design. The activities in support of the HTGR-SC/C Lead Plant (WBS 30 and 31) were the participation in the Lead Plant System Engineering (LPSE) effort and the plant simulation task. The efforts on the Advanced HTGR systems was performed under the Modular Reactor Systems (MRS) (WBS 41) to study the potential for multiple small reactors to provide lower costs, improved safety, and higher availability than the large monolithic core reactors.

20021 **Parametric effects in the rotating fluidized bed reactor.** Jones, O.C. Jr. (Rensselaer Polytechnic Institute Troy, NY 12181). *Transactions of the American Nuclear Society;* **45**: 848-850(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

20022 **(PNC-G—065-82-01) Proceedings of the 9th JUICE meeting on heavy water reactors.** (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Mar 1982. 230p. (CONF-8203159—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780150.

From 9. JUICE meeting on heavy water reactors; Tokyo, Japan (11 Mar 1982).

Separate abstracts are presented for each of the papers included in the data base.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 19727, 20082, 20093, 20094, 20095, 20154, 20160, 20193, 20194, 20196, 20197, 20198, 20199, 20200, 20203, 20204, 20206, 20226, 20227, 20245, 20266, 20267, 20268, 20269, 20286, 20287, 20289, 20442

20023 **(CNLM—5272) Fast breeder reactor study.** d'Arcy, R. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 4 Oct 1963. Contract AC02-84PW02789. 7p. NTIS, PC A02; 3; GPO Dep. Order Number DE84006896.

Paper copy only, copy does not permit microfiche production; Declassified 5 Nov 1975.

A study was conducted to determine the feasibility of developing an efficient breeder reactor based upon CANEL's lithium-cooled fast reactor technology. The Fermi reactor, a sodium-cooled stainless steel breeder reactor developed by Atomics Power Development Associates, Inc. (APDA), was chosen as a reference reactor and used as a basis for comparison. The breeding ratio, defined as the ratio of plutonium production to ^{235}U burn-up, was used to compare the Fermi reactor to the lithium-cooled reactor with various cladding materials. To obtain comparable results, the DSN code was used for all cases with a constant reactor configuration consisting of a spherical core 30.5 inches in diameter surrounded by a depleted uranium blanket 2 feet thick. The volume fractions of U^{235}, U^{238}, coolant and cladding, were kept constant (with two exceptions which will be discussed later) and equal to the material volume fractions used in AFDA's Fermi reactor. Various cladding materials were investigated in conjunction with ilthium to determine their effect on breeding ratio. The cladding materials investigated were columbian, titanium, vanadium, and zirconium. It was concluded that a lithium-cooled, columbium clad fast reactor does not appear competitive to the sodium cooled stainless steel clad reactor developed by APDA. However, use of titanium or zirconium as the cladding material in a lithium-cooled reactor offers a substantial increase in the breeding ratio. Further work along this line should be devoted to the development of a cladding material with a relatively low neutron absorption cross section.

20024 **A new fast breeder approach.** Folkrod, J.R.; Kann, W.J.; Klocksieben, R.H. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 553-554(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20025 **Theoretical analysis of the DC electromagnetic flow coupler.** Hughes, W.F.; Alexion, C.C. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). *Nuclear Engineering and Design;* **74**: No. 3, 367-376(Mar 1983).

A descriptive model and design procedure for the DC electromagnetic flow coupler is developed based on a quasi-one-dimensional analysis previously developed for the DC electromagnetic pump. It is shown that for a particular flow coupler geometry, the total efficiency and the pressure gradients through the pump and generator depend on two parameters - the Hartmann number and the ratio of the pump flow rate to generator flow rate. Thus, for a fixed Hartmann number the efficiency depends only on the flow ratio. However, for a fixed pressure rise through the pump it is shown that the efficiency depends only on the Hartmann number. Nomographs showing the operating characteristics and critical design points are presented. Example calculations for a full-size unit, suitable for use in a liquid-metal cooled fast breeder reactor, are also discussed using the design nomographs.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 19994, 20173

20026 **(NUREG—0540-Vol.5-No.12) Title list of documents made publicly available, December 1-31, 1983. Volume 5, No. 12.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Mar 1984. 538p. NTIS, PC A23/MF A01 - GPO. Order Number DE84900895.

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The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. This issue covers December, 1983.

20027 **(NUREG—0750-Vol.18-No.3) Nuclear Regulatory Commission issuances, September 1983. Vol. 18, No. 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Sep 1983. 452p. NTIS, PC A20/MF A01 - GPO. Order Number DE84900845.

This report includes the issuances received during September, 1983 from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors'

Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

20028 **Technical specification enhancements.** Young, G.G.; Mardis, D.G. (United Energy Services Corp. 8235 Dunwoody Place Atlanta, GA 30338). *Transactions of the American Nuclear Society;* **45**: 513(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20029 **Public participation in the licensing process.** Kearney, J.J. (Edison Electric Institute 1111 19th Street N.W. Washington, DC 20036). *Transactions of the American Nuclear Society;* **45**: 514(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20030 **Public participation in the licensing process.** Harding, J. (Friends of the Earth 1045 Sansome Street San Francisco, CA 94111). *Transactions of the American Nuclear Society;* **45**: 515(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20031 **Public participation in the licensing process.** Cotter, P.B. Jr. (U.S. Nuclear Regulatory Commission Washington, DC 20555). *Transactions of the American Nuclear Society;* **45**: 515-516(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2108 Economics

REFER ALSO TO CITATION(S) 20144, 20326, 20344

20032 **(NUREG/CR—3605) Evaluation of nuclear facility decommissioning projects: summary report. Plum Brook Reactor Facility.** Doerge, D.H.; Miller, R.L. (UNC Nuclear Industries, Inc., Richland, WA (USA). Decommissioning Programs Dept.). Feb 1984. 54p. NTIS, PC A04/MF A01 - GPO $4.25. Order Number DE84900916.

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This document summarizes information concerning the decommissioning of the Plum Brook Reactor Facility, which was placed in a Nuclear Regulatory Commission (NRC) approved safe storage configuration. The data were placed in a computerized information retrieval/manipulation system which permits future utilization of this information in decommissioning of similar facilities. The information is presented both in computer output form and a manually assembled summarization. Complete cost data were not readily available and decommissioning activities did not in all cases conform with current criteria for the SAFSTOR decommissioning mode, therefore no cost comparisons were made.

22 NUCLEAR REACTOR TECHNOLOGY

20033 **(NE—01-84-KWIC-Index) Nuclear Energy Standards. KWIC index.** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Jan 1984. 46p. Nuclear Standards Management Center, P.O. Box Y, Oak Ridge, TN 37831.

The KWIC Index is an alphabetical listing that provides rapid identification of NE standards based upon the specific subject areas. This index facilitates identification of a NE standard by major or key words located in the center of the alphabetical index listing. Alphanumerical designations for specific NE standards are shown in the right-hand column. Standards referenced in this listing include those that are active, inactive, or discontinued.

2201 Theory And Calculation

20034 **(EPRI-NP—3418) ENDF/B-V cross-section library for reactor cell analysis. Final report.** MacFarlane, R.E. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 75p. NTIS, PC A04/MF A01 - EPRI; GPO Dep. Order Number DE84009306.

Multigroup cross-section libraries have been prepared for the thermal power reactor code EPRI-CELL using the NJOY nuclear data processing system and ENDF/B-V evaluated nuclear data. Various combinations of scattering matrices, absorption and/or fission cross section, and self-shielding factors are included for the major fissile, fertile, fission product, structural, and moderator materials used in modern light water, heavy water, and graphite reactors. An extensive new set of actinide and fission product buildup and depletion chains is included. The processing methods and changes made to the codes EPRI-CELL, LIBRAR, GAMTAP, and BLIB in order to use the ENDF/B-V cross sections effectively are also described.

20035 **(ORNL-tr—5086) GRUCAL: a program system for the calculation of macroscopic group constants.** Woll, D. (Oak Ridge National Lab., TN (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). 1984. Contract AC05-84OR21400. Translation of KFK-2108, June 1975. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84009424.

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Nuclear reactor calculations require material- and composition-dependent, energy-averaged neutron physical data in order to decribe the interaction between neutrons and isotopes. The multigroup cross section code GRUCAL calculates these macroscopic group constants for given material compositions from the material-dependent data of the group constant library GRUBA. The instructions for calculating group constants are not fixed in the program, but are read in from an instruction file. This makes it possible to adapt GRUCAL to various problems or different group constant concepts.

20036 **COBRAIV-1 Convergence modifications.** Jones, J.H.; Firth, K.J. (Babcock & Wilcox Company P.O. Box 1260 Lynchburg, VA 24505). *Transactions of the American Nuclear Society;* **45**: 881-882(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20037 **On packed and fluidized-bed heat transfer: correct boundary conditions.** Jones, O.C. Jr. (Rensselaer Polytechnic Institute Troy, NY 12181). *Transactions of the American Nuclear Society;* **45**: 847-848(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20038 **Studies of annular flows in an air-water loop by stochastic analysis techniques.** Analytis, G.Th.; Lubbesemeyer, D. (Federal Institute for Reactor Research 5305 Wuringen). *Transactions of the American Nuclear Society;* **45**: 845-846(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2202 Components And Accessories

REFER ALSO TO CITATION(S) 20174, 20429

20039 **(AECL—5308) Deposition of magnetite particles from high velocity water onto isothermal tubes.** Burrill, K.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1977. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84900920.

The deposition rate of magnetite particles from a high velocity water slurry onto isothermal metal tubes was measured. The ef-

fects of velocity (5 to 100 m/s), slurry concentration (200 to 1000 mg Fe/kg H_2O), temperature (25° to 90°C), pH (4 to 10 at 25°C), and tube material (nickel, Zircaloy-4) on deposition rate were studied. The data are interpreted in terms of two steps in series for deposition: a mass transfer step followed by a deposition or inertial coasting step. Mass transfer of particles through the bulk water phase apparently limits the deposition of particles at high Reynolds number (10^5).

20040 **(AERE-R—10935) FACSIMILE code for calculating void swelling during pulsed irradiation; version VS6.** Windsor, M.E.; Bullough, R.; Wood, M.H. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Jun 1983. 14p. HMSO, London, price $2.00.

The report describes the sixth in a series of computer codes to model void swelling and creep during irradiation of reactor structural materials, using chemical rate theory equations. The VS6 code is the first to incorporate pulsed irradiation conditions. Necessary modifications were made to the VS5 version, which uses the latest physical models for predicting void swelling under constant irradiation conditions. This report should be used in conjunction with AERE-R.10683, as only the modifications which are relevant to pulsed irradiation are described.

20041 **(DP—1670) Cleaning agents for reactor heat exchangers.** Wilde, E.W.; Berger, L.R.; Berger, J.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Mar 1984. Contract AC09-76SR00001. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010096.

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At SRP, oxalic acid is occasionally used to remove an oxide film from the shell side of reactor heat exchangers (HXs). The single-pass flow-through procedure utilizing 100 ppM oxalic acid removes the fouling layer at a rate proportional to the water temperature. A comparison of the effectiveness of oxalic acid with other potential cleaning agents using test specimens from a fouled heat exchanger demonstrated that oxalic acid at comparable concentrations is superior to the alternatives. The effects of periodic treatment of the HXs with oxalic acid on carbon steel components in the system is small or negligible when the naturally formed protective corrosion layer is undisturbed. Although it does etch the bare metal, oxalic acid has little effect on the protective corrosion layer. Periodic use of oxalic acid on the HX system should not decrease the life of the carbon steel headers.

20042 **(EPRI-NP—3357) Condition monitoring of nuclear plant electrical equipment. Final report.** Sugarman, A.; Kumar, B.; Sorensen, R. (Nutech, San Jose, CA (USA)). Feb 1984. 80p. EPRI, Research Reports Center (RRC), Box 50490, Palo Alto, CA 94303.

Actual examples and potential techniques of Condition Monitoring (CM) are described for motors, cables, transmitters, circuit breakers and solenoids. This review was performed by discussions with manufacturers of Class 1E equipment, manufacturers of electrical test equipment, experts at national laboratories and a review of the published literature. A survey of CM and surveillance techniques was also performed at eight utilities which have or will soon have operating nuclear generating stations. It is concluded that CM is presently being used on heavy rotating equipment (e.g., turbine generators) and is technically possible for the lighter safety related equipment. Perceived barriers to the more widespread use of CM for plant equipment is the cost effectiveness of it and the difficulty in drawing conclusions on the health of the equipment from the test data.

20043 **(FEI—1375) Calculation of void fractions in channels with non-uniform wall heating.** Pomet'ko, P.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700775.

An approach to establishing the relation of burnout data with void fraction is suggested on the basis of an earlier derived parameter, rendered a conventional one. The possibility is shown of using experimental burnout data with non-uniform wall heating, and void fraction data with uniform heating for calculation of void fractions for an arbitrary heat release law, including transfer from heated to unheated parts.

20044 **(IS-T—1065) Design considerations for steel containments.** Fils, G.A. (Ames Lab., IA (USA)). Jan 1984. Contract W-7405-ENG-82. 254p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84007204.

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The containment response from an applied load must be resisted by the steel containment. The stresses or strains are random variables Q. The resistance capacity of the steel containment is some distribution of random variables R. Distributions of Q and R are not sufficiently well defined to allow probabilistic design of steel containments. However, the ASME Code places limits on stress which the unfactored load responses must not exceed. Nuclear containments differ from conventional structures in that severe plant mishaps and/or severe natural phenomena form the basis of design and the normal operating loads are dwarfed in comparison. Containment loads can be classified as either normal operation loads, internal events, or external events. Closed form solutions have limited application, so the containment shell is represented by a discretized mathematical model. One-dimensional beam finite elements can be used to model the containment shell under some circumstances. The dynamic response of the above two containment models can be found in the time or frequency domain. Time domain solutions can be found by modal analysis and/or time integration while frequency domain solutions can be found by the Fast Fourier Transform method.

20045 **(KURRI-TR—219) Report of the study meeting on research technology.** Shibata, Shunichi (ed.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1982. 42p. (CONF-8102102—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780149.

From Meeting on research technology; Kumatori, Osaka, Japan (10 Feb 1981).

Separate abstracts are presented for each of the papers included in the data base.

20046 **Gamma-ray irradiation test of an optical remote multiplexing system for a nuclear power station.** Yamauchi, T.; Adachi, K.; Hajimna, S.; Hanai, K.; Ishii, K.; Noguchi, A.; Ohhashi, H. (Mitsubishi Electric Corporation Power & Industrial Systems Center Wadasaki-cho, Hyogo-ku Kobe). *Transactions of the American Nuclear Society;* **45**: 675-676(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20047 **Containment air temperature, design, and management issues.** Grant, K.W.; Gilbert, K.T.; Patel, R.L. (Babcock and Wilcox Company P.O. Box 1260 Lynchburg, VA 24505). *Transactions of the American Nuclear Society;* **45**: 561-562(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2203 Fuel Elements

REFER ALSO TO CITATION(S) 20431, 20453

20048 (NIRS-M—35, pp 33-45) **Chemical forms of radioiodine. Radioiodine built-up during reactor operation.** Tachikawa, Enzo (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Release of radioiodine built-up during reactor operations presents a potential problem from the standpoint of environmental

safety. Among the chemical forms of radioiodine, depending upon the circumstances, organic iodides cast a most serious problem because of its difficulties in the trapping and because of its stability compared to other chemical forms. Furthermore, pellet-cladding interaction (PCI) fuel failures in LWR fuel rods are believed to be stress corrosion cracks caused by embrittling fission product species of radioiodine. To deal with these problems, knowledge is required of the chemical behaviors of radioiodine in and out of fuels, as well as the release behaviors from fuels. Here a brief review is given of these respects, in aiming at clearing-up the questions still remaining unknown. The data seem to indicate that radioiodine exists as a combined form in fuels. upon heating slightly irradiated fuels, the iodine atoms are released in a chemical form associated with uranium atoms. Experiments, however, as needed with specimen of higher burnup, where the interactions of radioiodine with metallic fission products could be favored. The dominant release mechanism of radioiodine under normal operating temperatures will be diffusion to grain boundaries leading to open surfaces. Radiation-induced internal traps, however, after the rate of diffusion significantly. The carbon sources of organic iodides formed under various conditions and its formation mechanisms have also been considered.

2204 Control Systems

REFER ALSO TO CITATION(S) 19995, 20293

20049 (CONF-840412—1) Potential safety enhancements to nuclear plant control: proof testing at EBR-II. Lindsay, R.W.; Chisholm, G.H. (Argonne National Lab., Idaho Falls, ID (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009187.

From American power conference; Chicago, IL, USA (24 Apr 1984).

Future changes in nuclear plant control and protective systems will reflect an evolutionary improvement through increased use of computers coupled with a better integration of man and machine. Before improvements can be accepted into the licensed commercial plant environment, significant testing must be accomplished to answer safety questions and to prove the worth of new ideas. The Experimental Breeder Reactor-II (EBR-II) is being used as a test-bed for both in-house development and testing for others in a DOE sponsored Man-Machine Integration program. The ultimate result of the development and testing would be a control system for which safety credit could be taken in the licensing process.

20050 (EPRI-NP—3323) Digital feedwater controller for a BWR: a conceptual design study. Carmichael, L.A.; Toye, G.; Ipakchi, A.; Sievers, M.W. (Systems Control, Inc., Palo Alto, CA (USA). Energy Systems Div.). Feb 1984. 199p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

The requirements for the replacement of an existing analog controller with a highly reliable microprocessor based digital controller were developed for the feedwater control system of the Monticello boiling water reactor. Based on an analysis of these requirements, a preliminary hardware and software design is described that uses a fault-tolerant dual-redundant microprocessor architecture with a design mission time of 10 years without loss of controller function. Examination of the system reliability requirements shows that a signal validation capability should be provided in the microprocessor's software to provide automatic controller reconfiguration in the event of a failure of the BWR water level or feedwater instrumentation. The preliminary design was validated by a simulation study of the proposed digital controller. The results of the simulation showed that a significant improvement in BWR water level control can be provided with the digital feedwater controller.

20051 (EPRI-NP—3419) Applications of cadmium telluride gamma detectors at nuclear power plants. Schmotzer, J.K.; Failey, M.P. (Babcock and Wilcox Co., Lynchburg, VA (USA). Lynchburg Research Center). Mar 1984. 67p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

Two prototype radiation detection devices using cadmium telluride crystals (CdTe) as the sensitive element have been constructed and tested. The first prototype device functioned as a radiation survey meter. In this application the crystal was used in two modes, the count rate mode and the current mode. Calibration curves for both ^{60}Co and ^{137}Cs radiation fields were prepared, with the count rate mode covering 1 to 1000 mR/h and the current mode covering 1 to 10 R/h. The performance of the prototype was compared with a Teletector (a gamma dose rate meter employing a Geiger Tube) in a radiation survey of the Oconee 2 containment building. The potential exists for building a very compact and sensitive instrument using currently available commercial hardware. Shortcomings of the detector include its energy dependence and a hysteresis effect in the current mode. The second prototype device used a spectroscopic grade crystal and was designed to scan the primary side surfaces of once-through steam generator (OTSG) tubes. This miniature spectrometer probe has been assembled and lab tested in radiation fields up to 2.5 R/h. Capability for the detection and resolution of the ^{60}Co 1173 and 1332 keV lines has been demonstrated.

20052 (UCID—20038) Technical evaluation report on the neutron detector decalibration at the Fort St. Vrain Nuclear Generating Station (Docket No. 50-267). Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 23 Mar 1984. Contract W-7405-ENG-48. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008019.

This report documents the technical evaluation on the decalibration of the neutron detectors at the Fort St. Vrain Nuclear Generating Station. The evaluation is to determine that the added circuitry for generating a floating trip setpoint as a function of indicated power meets NRC design criteria and has no adverse effects on the plant protection system. The evaluation finds that the floating trip setpoint circuitry meets the design criteria specified in the plant's FSAR and will produce a reactor trip (as a function of indicated power) before the true power limit value in the Technical Specifications is exceeded.

20053 Demonstration of decision analysis techniques for steady-state reactor control. Bernard, J.; Kwok, K.; Lanning, D.; Ray, A. (Massachusetts Institute of Technology Cambridge, MA 02139). *Transactions of the American Nuclear Society;* **45**: 661-662(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20054 Computer program for power changes and load following. Wilder, D.W. (Duke Power Company Catawba Nuclear Station P.O. Box 256 Clover, SC 29710). *Transactions of the American Nuclear Society;* **45**: 662-663(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20055 Development of fault tolerant control systems for nuclear power applications. Asami, K.; Hirose, M.; Ito, T.; Yanai, K. (Hitachi, Ltd. Ohmika Works 5-2-1 Ohmika, Hitachi Ibaraki, 319-12). *Transactions of the American Nuclear Society;* **45**: 663-664(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20056 Outage management plan. Randles, W.J.; Bryson, R.D. (Sargent & Lundy 55 E Monroe Street Chicago, IL 60603). *Transactions of the American Nuclear Society;* **45**: 531(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20057 Replacement of a nuclear power plant's process computer. Golino, D.F.; Ranft, D.J. (Burns & Roe, Inc. 650 Winters Avenue Paramus, NJ 07675). *Transactions of the American Nuclear Society;* **45**: 534-535(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20058 **Implementation of a configuration management program for nuclear plant simulators.** Danna, R.; Trent, C.S. (General Physics Corporation 1000 Century Plaza Columbia, MD 21044). *Transactions of the American Nuclear Society;* **45**: 558-559(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20059 **Impact of uncertainties in ^{238}U resonance parameters on performance parameters of thermal lattices.** Wright, R.Q.; De Saussure, G.; Perez, R.B. (Oak Ridge National Laboratory Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **45**: 701(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20060 **A methodology for allocating nuclear power plant control functions to human or automatic control.** Overbey, C.M.; Jenkins, J.P.; Price, H.E.; Pulliman, R. (U.S. Nuclear Regulatory Commission, Washington, DC 20555). *Transactions of the American Nuclear Society;* **45**: 358(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20061 **Procedure monitoring as an extension to SPDSs.** Long, A.B.; Cain, D.; O'Brien, J. (Electric Power Research Institute, 3412 Hillview Avenue, P.O. Box 10412, Palo Alto, CA 94303). *Transactions of the American Nuclear Society;* **45**: 359-360(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20062 **A framework for design of operator planning/decision aids.** Yufik, Y.M.; Sheridan, T.B. (GA Technologies, P.O. Box 81608, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **45**: 360-362(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20063 **Optimizing the roles of man and computer in nuclear power plant control.** Colley, R.W.; Seeman, S.E. (Westinghouse Hanford Company, P.O. Box 1970, Richland, WA 99352). *Transactions of the American Nuclear Society;* **45**: 362-363(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 19803, 19804, 20189, 20735

20064 (NIRS-M—35, pp 3-18) **Release to the environment and diffusion of radioiodine in the environment, 1. Release to the environment and inventory.** Murata, Toshifumi (Nippon Nuclear Fuel Development Co. Ltd., Oarai, Ibaraki). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

1. Radioactivity of iodine nuclides accumulated in nuclear facilities. Radioactive iodine nuclides which are produced in nuclear plants consist mainly of short lived ^{131}I-^{135}I, while ^{129}I with long half life is being produced in a small amount. The radioactivity of iodine in a power reactor of 1,000 MWe which burns uranium fuel amounts to about 6 x 10^8 C sub(i). In the case of fuel which is handled in a reprocessing plant of spent fuel, almost all radioactive iodine remaining in the fuel is ^{129}I (half life: 1.7 x 10^7 years) because of cooling period of more than 6 months which is imposed by the plant. 2. Release of radioactive iodine during normal operating conditions. In an event of fuel failure in light water cooled reactors, a part of radioactive iodine is dissolved in water and very small amount is released as gaseous iodine to the environment through the ventillation system. The actual amount of radioactive iodine which was released from various types of nuclear reactors in the world between 1970 to 1974 is recorded as much lower than to the presently regulated value in all cases. 3. Behavior of radioactive iodine during postulated accident. The amount of radioactive iodine which will be released from reactor core to the containment vessel varies with conditions to be assumed. In the event of a severe accidental condition such as fuel melt down or oxidation, 25% of radioactive iodine in the fuel are assumed to be released. The iodine released to the containment vessel is mostly removed by planting out to the wall of the containment or washed out by core spray, while the remaining part in air is to be removed by a filter unit which is installed in the emergency gas treatment system.

20065 (NIRS-M—35, pp 256-273) **Some aspects of dose evaluation, 3. Examples of dose assessment.** Yoshida, Yoshikazu (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

This paper describes methods of calculating the radioiodine releases and resultant doses in the "Guide for calculation of doses to man from routine releases of effluents from light-water-cooled nuclear power plants for evaluating compliance with dose objectives around a site of LWRs" by the Japan Nuclear Safety Commission. Examples of dose calculation in the design stage of plants and releases of radioiodine from operating plants are also given. The thyroid dose objective from radioiodine in reactor effluents was determined to be 15 mrem per year by the AEC of Japan in 1975. In the guide, models and parameters are given as most realistic on the basis of current knowledge and experience; in cases involving unknown factors these are on conservative side. Calculations of annual average releases of gaseous and liquid effluents are made using the models and parameters established through operational experiences of the LWR plants. Annual thyroid doses are calculated from inhalation and ingestion of leafy vegetable and cow's milk for gaseous effluents and ingestion of marine food for liquid effluents. In calculation of the thyroid dose, fw = 0.2 is used instead of = 0.3 in ICRP publ. 2 for ingestion of foods excluding seaweed and the specific activity method for ingestion of foods including seaweed. It is because Japanese take foods with much stable iodine. Calculated annual releases of ^{131}I in gaseous effluents of typical BWR (1100 MWe) and PWR (800 MWe) are about 2 Ci and 0.7 Ci per year per plant and the annual thyroid doses are about 4 mrem and 9 mrem per year, respectively. Actually, however, releases of ^{131}I in gaseous effluents from the operating LWR plants are about less than one tenth of the above figures.

20066 (NIRS-M—35, pp 323-328) **Topics: behavior of radioactive iodine in power reactor building.** Yasumoto, Tadashi (National Inst. of Radiological Sciences, Chiba (Japan)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Some findings were obtained a few years ago in the examination on the behavior of radioactive aerosol such as radioactive iodine around the pool which has been used for fuel inspection or replacement above the reactor in the reactor building at the time of the regular inspection for a power reactor. The gaseous radioactive materials in the reactor seems to be released and diffused in the building quickly after opening the lid of the reactor. Then, a May-Pack type air sampler was made, and the concentration of radioactive iodine ^{131}I was determined by measuring activity in each layer separately through absorbing air by installing it under the venting duct. The iodine concentration level increased little during several hours after opening the lid, but greatly increased its level in air after the lid was completely removed and moved. With this, it was found that the radioactive iodine was released as the aerosol in the condition of considerably strong particle property. Comparison of ^{131}I change with that of ^{54}Mn in course of time after opening the lid allows the estimation that the mechanism of generation of both aerosols is similar, and the generating rates of both aerosols are approximately constant, while short-lived ^{131}I is decaying naturally and faster than ^{54}Mn. It was also found in this examination that the

radioactive iodine can become the main hazard in regular inspection only for about a month in the reactor building environment, and after that, ^{54}Mn is rather the predominant contaminant.

20067 (PNCT—831-80-01, pp 166-170) **Preliminary estimation for derived working limit of tritium concentration in sea water off the PNC Tokai fuel reprocessing plant.** Shinohara, Kunihiko; Kishimoto, Yoichiro; Kitahara, Yoshihisa (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1980. NTIS (US Sales Only), PC A09/MF A01.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Jan 1979 - Mar 1980.

Tritium is the most abundant radionuclide in the liquid waste discharged from the PNC Tokai fuel reprocessing plant to the Pacific coastal water. The discharged quantity of tritium, mainly as tritiated water, should not exceed 1.89×10^{15} Bq (5.11×10^{4} Ci) per year. Since the tritium in sea water will be incorporated into marine organisms, important foodstuff for Japanese people, the potential risk of tritium discharged in the sea cannot be excluded. Estimation is proposed on the derived working limit (DWL) in the sea water off the PNC Tokai fuel reprocessing plant. The daily intake of marine foodstuff was estimated for the critical group near the reprocessing plant. The value of 3×10^{9} Bq per m^3 (8×10^{-2} Ci per m^3) was obtained as the DWL of tritium concentration in the sea water off the Tokai fuel reprocessing plant.

20068 **Licensing retrofit incinerators at commercial nuclear power plants.** Thompson, J.D.; Edwards, C.W.; Vito, D.J. (EG & G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **45**: 646(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20069 **A central incinerator for low-level waste management.** DiSalvo, R.; Burian, R.J. (Battelle Columbus Laboratory 505 King Avenue Columbus, OH 43201). *Transactions of the American Nuclear Society;* **45**: 647-648(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20070 **Rotary kiln incinerator engineering tests on simulated transuranic wastes from the Idaho National Engineering Laboratory.** Hedahl, T.G. (EG & G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **45**: 649-651(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20071 **Ion-exchange resin incineration using a controlled-air incinerator.** Koenig, R.; Abrams, R.F. (Los Alamos National Laboratory P.O. Box 1663 Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **45**: 646-647(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 20032, 20049, 20118, 20143, 20146, 20201, 20202, 20260

20072 **(CNLM—3951) Preliminary reactor shield specifications, PWAR-16 reactor experiment.** Smolen, J.R.; Zeisser, M.H. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 31 Jan 1962. Contract AC02-84PW02789. 18p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007651.

Paper copy only, copy does not permit microfiche production; Declassified 8 Dec 1975.

Preliminary design requirements and specifications for the PWAR-16 reactor shield are presented. Preliminary reactor shield design layouts and necessary detail fabrication drawings are to be prepared based on these requirements and specifications. Revisions to these specifications and supplementary data affecting the design based on results of analyses, material evaluation programs and possible revised shielding requirements will be published as supplements to this memorandum.

20073 **(CNLM—3951-Suppl.1) Preliminary reactor shield specifications, PWAR-16 reactor experiment.** Zeisser, M.H. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 22 Feb 1962. Contract AC02-84PW02789. 2p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007654.

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Revision to the shield design involve: The size of borated graphite blocks to be used; the use of stainless steel-405 as structural material instead of mild steel; a protective covering for the outer surface of the Superex M insulation and the use of air as coolant rather than argon. The reasons for the charges are given. (LTW)

20074 **(CNLM—4177) SNAP-50-DR-1 reference conditions.** Perry, P.I. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 12 Jul 1962. Contract AC02-84PW02789. 3p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007640.

Paper copy only, copy does not permit microfiche production; Declassified 12 Jan 1976.

As a result of a meeting held on June 25, 1962 reference design conditons were established for the SNAP-50-DR-1 reactor and primary system. These conditions have been selected to enable proceeding with component design at an early date. This memo is written to summarize the SNAP-50-DR-1 reactor and primary system flows, temperatures and pressures in an attempt to insure that consistent numbers are being used. Major components of the primary system will consist of one reactor, 2 pumps, 2 boilers and associated piping and auxiliaries. The system is shown schematically in Fig 1.

20075 **(CNLM—5709-Suppl.15) Capsule operating summary.** Cunniff, C. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 4 Mar 1965. Contract AC02-84PW02789. 37p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007122.

Paper copy only, copy does not permit microfiche production; Declassified 23 Mar 1972.

20076 **(CNLM—5752-Suppl.4) Index of documents and drawings transmitted to A/E.** Daddario, A. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 21 Aug 1964. Contract AC02-84PW02789. 12p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007108.

Paper copy only, copy does not permit microfiche production.

This report contains a list of report titles and report numbers, drawings, instrument diagrams, etc. mostly related to SNAP reactors.

20077 **(CNLM—5777) Request for shielding requirements for semiconductor controlled rectifiers.** Allen, J.E. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 19 Jun 1964. Contract AC02-84PW02789. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007131.

The revised reference design incorporates a semiconductor controlled rectifier in place of a 400 cps auxiliary generator. Since this component is more sensitive to radiation than an auxiliary generator, shielding protection will be required. The radiation dose limits for components other than electronic equipment fall above the SCR range (Reference 4), indicating local shielding requirement. Since there is some uncertainty in the placement and radiation limits of the SCR, it is requested that the local shielding requirements for the cases listed be considered.

20078 **(CNLM—5787) Revised classification guide for the SNAP-50/SPUR program.** (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). Jun 1964. Contract AC02-84PW02789. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007137.

Declassified 23 Mar 1972.

This revised guide incorporates those changes which would both alleviate classification problems associated with materials procurement, see referenced letter, and still protect data and information on the detailed design and the results of engineering evaluations.

20079 **(EGG-M—12583) Hardware design for the production of NTD silicon in the Advanced Test Reactor.** Schell, M.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 9 Feb 1984. Contract AC07-76ID01570. 17p. (CONF-840272—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007664.

From 5. international neutron transmutation doping conference; San Jose, CA, USA (9 Feb 1984).

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The Advanced Test Reactor (ATR) is a 250-MW(t) materials testing and nuclear research facility operated for EG and G Idaho, Inc. The unique capabilities of the ATR can be readily adapted via hardware to produce large quantitities of large-diameter (20 cm plus) doped silicon crystals. Conservative estimates place the production capability in excess of 15 metric tons per year. The proposed hardware is based upon a closed-loop, hydraulic-shuttle tube system.

20080 **(EGG-M—14083) Potential for large-diameter NTD silicon production in the Advanced Test Reactor.** Herring, J.S.; Korenke, R.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 9 Feb 1984. Contract AC07-76ID01570. 14p. (CONF-840272—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007665.

From 5. international neutron transmutation doping conference; San Jose, CA, USA (9 Feb 1984).

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The Advanced Test Reactor (ATR) is a 250-MW(t) flux-trap reactor located at the Idaho National Engineering Laboratory (INEL). Within the reflector are four 124-mm-diameter I-holes, which are available for silicon irradiation. Two large irradiation volumes of 0.5 m x 0.4 m x 1.2 m and 0.5 m x 0.2 m x 1.2 m are also available for transmutation doping. Thermal fluxes in these locations range from 0.56 to 23.0 x 10^{12} nt/cm^3-s. Use of the ATR for providing neutron transmutation doping (NTD) services in sizes not available elsewhere in the United States may be feasible.

20081 **(FXM—6825) Comparison of P and W A's and Airsearch's Structural Systems for SNAP-50 vehicle.** Oslick, H.; Aleo, J.P. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 5 Dec 1963. Contract AC02-84PW02789. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007045.

The structural concept proposed by Pratt and Whitney Aircraft (P and W A) for the SNAP-50 vehicle is compared with that proposed by AirResearch Manufacturing Company. P and W A proposes a titanium column-frame type structure while AiRearch maintains that all launch and vibration loads can be carried through the radiator and fin structure. It is concluded that: (1) The AiResearch structural concept, modified to conform to the loading and temperature requirements that P and W A has been using, will weigh 416 lbs more than the P and W A concept. (2) 440 lbs of structure must be added to AiResearch's radiator to take expected launch loads even with no preheat requirement, (i.e., room-temperature launch). (3) No weight advantage is seen in using the radiator as an aerodyanamic shroud. 7 references.

20082 **(NUREG/CR—3603) MINET validation study using EBR-II test data.** Van Tuyle, G.J. (Brookhaven National Lab., Upton, NY (USA)). Nov 1983. Contract AC02-76CH00016. 43p. (BNL-NUREG—51733). NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. Order Number DE84009542.

Portions are illegible in microfiche products.

A natural circulation test transient performed at the EBR-II facility is simulated using the MINET computer code, and calculated results are compared against data from the plant. The MINET EBR-II representation includes much of the intermediate loop and the steam generator system, and corresponds to the portion of the plant usually represented by MINET when it is executed with SSC, the Super System Code. MINET calculations agreed well with the plant transient data, with discrepancies well within uncertainties in thermocouple time constants and boundary conditions.

20083 **Water level measurement using fast neutron detectors.** Baratta, A.J.; Jester, W.A.; Okyere, E.W. (Pennsylvania State Univ. University Park, PA 16802). *Transactions of the American Nuclear Society;* **45**: 873-874(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20084 **Installation and start-up experience of Westinghouse reactor vessel level instrumentation.** Kalita, R.S.; Bayer, R.K.; Lyman, W.G. (Sargent & Lundy 55 E. Monroe Street Chicago, IL 60603). *Transactions of the American Nuclear Society;* **45**: 873(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20085 **Monitoring reactor vessel liquid level with a vertical string of SPNDs.** Adams, J.P.; Berta, V.T. (EG & G Idaho Inc. P.O. Box 1625 Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **45**: 870-872(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20086 **Fissile sample worths in uranium/iron benchmark.** Schaefer, R.W.; Bucher, R.G. (Argonne National Laboratory P.O. Box 2528 Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **45**: 771-773(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20087 **Analysis of three idealized reactor configurations: Plate, pin, and homogenous.** McKnight, R.D. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 760-761(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20088 **Determination of optimal core fissile loadings in the TREAT upgrade reactor.** Bhattachryya, S.K.; Lell, R.M.; Ulrich, A.J.; Yang, S. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 757-759(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20089 **Extended capacity high-speed disk recording system for the TREAT Hodoscope.** Rhodes, E.A.; Burrows, D.; DeVolpi, A.; Ray, D.; Stanford, G.; Travis, D. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 257-258(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20090 **Comparison of calculated and observed cyclic stress-strain relationships for Inconel alloy 625 at 650° to 1100°C.** Purohit, A.; Ewing, T.F.; Thiele, U. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 287-288(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20091 **Fatigue strength and evaluation of creep damage during fatigue cycling of Inconel alloy 625.** Purohit, A.; O'Donnell, J.E.; Thiele, U. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 288-289(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20092 **High-temperature reverse-bend fatigue strength of Inconel alloy 625.** Purohit, A.; Greenfield, I.G.; Park, K.B. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 289-291(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20093 **Eutectic-penetration-induced cladding rupture in EBR-II driver fuel elements.** Betten, P.R.; Bottcher, J.H.; Seidel, B.R. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 300-301(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20094 **High-ramp-rate transient performance of EBR-II metallic driver fuel.** Siedel, B.R.; Hemsley, E.K. (Argonne National Laboratory P.O. Box 2528 Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **45**: 302-303(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20095 **Fabrication of UO_2 -stainless steel fuel for a fast reactor safety test.** Rhude, H.V.; Noland, R.A.; O'keefe, G.B. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 308-309(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20096 **EBR-II search for the lost subassembly.** King, R.W.; Buschman, H.W.; Poloncsik, J.; Remsburg, J.S.; Sine, H.W. (Argonne National Laboratory P.O. Box 2528 Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **45**: 563-564(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20097 **Calibration of the ARMF reactor for low absorber cross section measurements.** Harris, J.M.; McDaniel, P.J.; Milsap, D. (Sandia National Laboratories P.O. Box 5800 Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **45**: 708-709(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2207 Plutonium And Isotope Production Reactors

20098 **The availability and uses of heavy actinide isotopes.** Carnall, W.T. (Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 242(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20099 **^{238}Pu processing at Savannah River Plant.** Burney, G.A. (Savannah River Laboratory E.I. Du Pont De Nemours & Co. Aiken, SC 29808). *Transactions of the American Nuclear Society;* **45**: 247-248(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2208 Propulsion Reactors

REFER ALSO TO CITATION(S) 20145, 20149, 20456, 21626

20100 **(CNLM—1311) Develop multiple electrode holder (603) radiation). Final report, Project 183.** Asmond, L.H. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 6 Oct 1958. Contract AC02-84PW02789. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010195.

Two types of multiple electrode holders were designed. Of the two (2), the mechanical type proved to be the most efficient in so far as ease in loading, setting and maintaining true electrode position. 3 figures.

20101 **(CNLM—1384) Development of Case-Impeller Housing (T-1000473 and T-1000478). Final report, Project 1616.** Asmond, L.H. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 3 Dec 1958. Contract AC02-84PW02789. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010202.

To facilitate fabrication and alleviate the prohibitive expensive costs of forgings, billets, tracing fixtures and templates, it was decided to design punches and develop techniques for forming the Case-Impeller Housing on the 32" Cincinnati Hydroform. Initial development indicated a 3/8" thick by 30" dia stainless steel blank was necessary. Inspection of the blank after forming @ an indicated gauge reading of 9800 P.S.I., showed 75% conformation, with full conformation to the upper portion of the punch. The second attempt was made with a smaller blank (3/8" thick x 28" dia.). Pressure was applied at a slow constant rate until there was an indicated gauge reading of 9500 P.S.I. (1490 tons) and held for approximately thirty (30) seconds to allow the material to creep tightly against the punches. The part at this point was formed to within 95% of full conformation to the punch. It was necessary therefore, to fully anneal and restrike the part to realize full conformation. Sample parts examined by the Met. Lab. indicated no detrimental structural stress or cracks. Dimensional inspection of the finished parts met all requirements. Hydroforming the Case-Impeller Housing parts proved to be the most economical and practical method.

20102 **(CNLM—1429) Significant accomplishments.** Strough, R.I. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 11 Feb 1959. Contract AC02-84PW02789. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010210.

Portions are illegible in microfiche products; Declassified 8 Oct 1971.

During the past year the major portion of the effort at CANEL has been devoted to three areas of activity: (1) A forced convention loop constructed of columbium-.75 per cent zirconium alloy has been successfully operated with a maximum lithium temperature of 2000°F and a ΔT of 400°F for 250 hours without external evidence of corrosion or mass transport. This is backed up by approximately 25,000 hours of forced convection loop testing with lithium at lower temperatures. (2) A number of fuel pins consisting of a BeO-UO_2 ceramic core encapsulated in molybdenum-.5 per cent titanium tubing and employing helium as the heat transfer medium between the ceramic core and the inside tube wall have been irradiated in the MTR for periods up to 685 hours at temperatures up to 1800°F and a power density of 6 kw/cc in the ceramic with no detectable deterioration. The maximum burnup obtained was in excess of 7 per cent. (3) A critical assembly representing a lithium-cooled columbium intermediate spectrum reactor of approximately aircraft prototype size has been operated to provide a preliminary value of the critical mass, data on control effectiveness,

and radial and axial power distribution information. The experimental value of the critical mass of 144 kg compares very favorably with the calculated value of 134 kg, and supports, from a nuclear standpoint, the selection of columbium as a satisfactory structural material for an intermediate reactor. The effectiveness of the control drums determined by experiment confirms the calculation of control effectiveness, and the power distribution as determined by measurement, is wll within engineering requirements.

20103 **(CNLM—1441) Beam and fuel pin fabrication. Final report, Project 1054.** Peterson, C.N. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 13 Jan 1959. Contract AC02-84PW02789. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010207.

A longitudinal weld along the entire length of the beam encompassing several fuel pin joints added an unnecessary amount of weld metal to the structure without enhancing the weld soundness of the joint. The reduction in heat derived by welding each fuel pin-beam joint individually guaranteed a minimum amount of distortion while still providing the necessary high quality bond. A standard HW-9 Hand Torch was used with a setting of approximately 12 amps. on a P and H 300 ampere Inert Arc Welder for all welding on the CDT-1075 Weld Specimens. Argon gas was utilized as an atmosphere protection medium during the welding cycle. Each beam was tack welded in two places on both ends and then ground down to the +- 1 mil flushness required. All joints were qualitatively inspected by x-ray and Dye Check to insure soundness. it is recommended that on all small scale terminal welds of this nature, the to be welded components be extended approx. 40 mils beyond their mating parts to prevent weld burn-thru at the joint. 3 figures.

20104 **(CNLM—2354-Suppl.1) Preliminary subsystems data for NJ-18 powerplant.** Andrews, N.D. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 19 Apr 1960. Contract AC02-84PW02789. 2p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007141.

Paper copy only, copy does not permit microfiche production; Declassified 8 Dec 1975.

This report presents additional cooling requirements for the subsystems of the twin reactor, six engine NJ-18 powerplant which are described in CNLM-2354. The subsystems include the reactor shield coolant system, the engine fuel and lube oil cooling systems, and the liquid metal pump inert gas and lube oil cooling system. The additional requirements are shown in Table I. The data are for sea level static operation on an Air Force standard hot day and a total reactor power of 480 MW.

20105 **(CNLM—2413) Catalog of radiation facilities.** Fine, A.M. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 29 Mar 1960. Contract AC02-84PW02789. 28p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007007.

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The past and present radiation damage programs have been carried out in the Materials Testing Reactor and the Engineering Test Reactor which have been suitable for the programs run to date. Future requirements may dictate the investigation of items which may not lend themselves to irradiation in either of these reactors. Accordingly, a survey has been made of reactors which may be suitable for future radiation effects studies. Twenty-five reactors have been cataloged and a summary of the pertinent features of each has been prepared.

20106 **(CNLM—2481) Powerplant information for Major Wilson.** Larson, J.W. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 12 Apr 1960. Contract AC02-84PW02789. 5p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007142.

Paper copy only, copy does not permit microfiche production; Declassified 9 Oct 1964.

The nuclear J-58 turbojet engine with the 1800F NaK radiator, having the performance presented in FXD-461 and FXD-465, was matched to the airflow available from the NAA B-70 inlet, and as a result the J-58 performance was restricted. The thrust of the J-58 at maximun engine rotor speed for nuclear chemical operation with maximum after burning has been estimated and is presented in Fig 1. The thrust presented in FXD-465 for the restricted B-70 airflow is alo plotted in Fig 1 for comparison. The estimated specific fuel consumption at partial afterburning at Mach 3.0 and 65,000 feet altitude is plotted in Fig 2 for various engine rotor speeds. This graph illustrates the improvement in specific fuel consumption for increased engine airflow. The reasons for the various inflection points that occur in the performance data described in FDX-461 and FXD-465 are discussed.

20107 **(CNLM—3069) Typical operating cycle of an airplane powered by the NJ-18A powerplant.** (Pratt and Whitney Aircraft, Middletown, CT (USA)). 1 Nov 1960. Contract AC02-84PW02789. 3p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007150.

Paper copy only, copy does not permit microfiche production; Declassified 12 Jan 1976.

This report is a copy of FXM-4667 prepared for use external to Pratt and Whitney Aircraft. Table I of this report presents the flight Mach numbers, flight altitudes, operating times, and engine power settings which define a typical operating cycle of an airplane powered by the NJ-18A powerplant. The flight portion of the operating cycle may be described as a combination airborne alert-low altitude penetration mission. The alert portion of the mission is performed at high altitude with a relatively low nuclear power setting, and continues for approximately 100 hours. The penetration is performed at a high subsonic speed and requires a high nuclear power setting, but the time required for the penetration is only three hours. The total time required to complete a mission, including takeoff and landing, cruise to and from the loiter area, and climb and descent, is 120 hours. Chemical fuel is used for the takeoff, initial climb and landing portions of the mission. the ground portion of the operating cycle consists of the ground handling, inspection, maintenance, and check-out operations plus a storage period which was chosen to make the total time per powerplant cycle correspond to the average cycle time of the Convair NX-series airplanes.

20108 **(CNLM—3833) Allowable pressures in the in-pile capsule, inner case (T-1015043).** Smith, L.F. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 26 Sep 1961. Contract AC02-84PW02789. 3p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007660.

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The object of this report is to determine the maximum allowable differential pressures that the Inner Case can withstand consistent with current design practice. Maximum allowable differential pressures are determined for a temperature range of 1500F to 1900F and for design lifetimes of 1000 h and 10,000 h. Internal and external differential pressures are considered with appropriate factors of safety. The inner case (T-1015043) of the In-Pile Capsule is a type 316 stainless steel right circular cylinder of .940 in. nominal diameter, .0487 in. nominal thickness and 8.233 in. length. It is closed at each end with a type 316 stainless steel circular flat plate .25 in. thick which is inserted into the inner case and welded. Within the inner case is contained a volume of NaK with a He gas cover under pressure. The inner case is surrounded by a pressurized He atmosphere. Allowable pressures are determined for two possible conditions - a predominant internal pressure causing membrane tension and a predominant extermal pressure causing membrane compression and possible buckling. The discontinuity - type stresses associated with the junction of the inner case and the end plugs have been investigated and found to be secondary. The predominant internal pressure differentials are limited to those producing stresses, as determined by conventional membrane analysis, equal to one-half the stress rupture value. 1 figure.

20109 **(CNLM—3955) Summary of liquid media test hours experience in Mechanical Metallurgy Laboratory.** Stewart, J.R.; Rowe, G.H. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 23 Jan 1962. Contract AC02-84PW02789. 2p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007653.

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We have taken an inventory of our liquid media test experience in the Mechanical Metallurgy Laboratory. Records back to 1955 have been surveyed. A summary of test hours operation for uniaxial creep-rupture and biaxial tube burst tests in various liquid media, shown below, totals 570,476 hours as of January 10, 1962. Total time of liquid media test experience: 570,476 hours.

20110 (CNLM—3968) Technical discussion at ORNL. Dytko, E.R.; Raring, L.M. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 7 Feb 1962. Contract AC02-84PW02789. 3p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007657.

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ORNL have irradiated UO_2-BeO, inconel clad fuel, to 5% burnup and temperatures from 600 to 1200°C. Fission gas release has been very low, .3 to .4%. O.D. increase was 0.5 to 2.4% and length up to 3.5%. Tests of B_4C in sodium at 1500F for 100 to 500 hours showed .4 to 1.5% weight loss of B_4C (Reference ORNL-2391); B_4C tests in NaK at 1200F to 1600F for 110 hours resulted in disintegrated specimens but they could have damaged on examination (Reference BMI-1132). ORNL have conducted a fairly extensive program on BeO irradiation. A total of 57 samples have now been irradiated in the ETR using ARE machined pieces of both hot pressed and cold pressed-sintered material. Specimens irridated at different NVT and different temperatures were examined by x-ray diffraction and petragraphic. Be compatibility in NaK and 304 SS with 0.002″ spacing shows a loss of 10.9 milligrams/in² in 1000 hours and 1500F. There is no loss with 0.050″ spacing. Irradiation data up to 6 x 10^{20} fast flux is presented in a preprint. Effective annealing occurs at 400C. ORNL sees no problem in our use of Be in the reflector at the proposed temperature and flux conditions. Be should be good in air to 700F. They have run inpile tube-burst specimens of Cb-1 Zr alloys to 1000 hours with only slight reduction in stress-to-rupture. For test details refer to ORNL-3213.

20111 (CNLM—4050) Microprobe analysis of UC-Cb compatibility test C-20-8. Manzione, A.V. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 19 Apr 1962. Contract AC02-84PW02789. 3p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007617.

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As part of the UC-Cb compatibility program, a columbium-1% zirconium fuel pin containing a uranium carbide pellet was run for 200 hours at 2200F in vacuum. Two portions of the test capsule were mounted in Bakelite and metallographically polished. A scintillation counter, used in conjunction with a curved LiF crystal, monitored the uranium scans which were made across the tubing. Reproduced in this report is the uranium gradient across the center section of tubing which was in contact with the UC pellet during testing; only this area showed a reaction. Two distinct diffusion zones were noted. At the ID and extending to a depth of about .5 mil is a 22 w/o uranium-78 w/o columbium solution. The second zone observed is not as wide. Penetrating an additional .3 mil is a uranium rich layer whose chemical composition is 65 w/o uranium, 35 w/o columbium. This is the first in a series of tests on UC-Cb compatibility.

20112 (CNLM—4051) Compatability study of uranium carbide with Cb-1Zr. Test Number C20-8. Fassler, M.H. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 25 Apr 1962. Contract AC02-84PW02789. 3p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007621.

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Three columbium-1 zirconium capsules were fabricated, each containing high density sintered uranium carbide pellets separated by molybdenum and tantalum spacers. The capsules were welded closed in an argon atmosphere and heated to 2200F for 200 consecutive hours in a millite vacuum retort at 5 x 10^{-5} torr. The estimated carbon contents in the three pins were 4.80, 4.85 and 4.90 weight percent. One uranium carbide pellet in one pin was wrapped in tantalum foil. Microscopic examination of the pins after test showed that a reaction occurred between tantalum and uranium carbide, and molybdenum and uranium carbide in pin number H and pin number I. It appears that tantalum foil aided in preventing carbon diffusion in the columbium-1 zirconium cladding. In pin S, the only pin with a tantalum wrapped pellet, no evidence of a reaction was found in the areas in contact with tantalum foil. however, areas in direct contact with UC did show some reaction.

20113 (CNLM—4103) Chemical heating requirements for lithium-filled radiator. Rencenberger, R.W. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 18 May 1962. Contract AC02-84PW02789. 3p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007616.

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A brief study was made of a chemically fueled radiator heating system, to determine basic data such as weights and quantity of reactants. The system concept involved heating the folded radiators by a flow of combustion products. The system dead weight is approximately 6300 lbs., 4300 lbs. of which is insulation; and 500 lbs of reactants (LOX and LH_2) are carried. Combustion is initiated on command from the guidance or from the ground and the combustion products flow over and heat the folded radiator. When a proper temperature is reached, the radiator is filled with working fluid (lithium). The power system heat source is started, and begins to dump heat into the radiator. At some temperature near the radiator operating level, the outer shell, head, and insulation are jettisoned and the radiator extended. The inner head, combustor, reactant tanks, and, if desired, the inner shell and insulation are jettisoned.

20114 (CNLM—4272) Time-power-probability relations of segmented space radiators. Gaffin, W.O. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 8 Oct 1962. Contract AC02-84PW02789. 4p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007643.

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The relationships among exposure time, power output, and meteoroid survival probability have been estimated for a typical space powerplant utilizing a segmented radiator. Figure 1 shows the time-power-probability relationships for a space powerplant employing a large number of independent radiator segments. The powerplant is designed to produce full rated power with all segments operating and to have a 0.9 probability of at least 75% of the heat rejection area surviving meteoroid damage until the end of the mission. The critical propulsion power requirements of the Typical Mission of Reference 2 are superimposed on Figure 1 to illustrate the use of the time-power-probability data. The curve shows that the probability of the powerplant producing the required 90% of rated power until the end of the Escape and Transfer stage is approximately 0.8. However, the probability of obtaining the required 90% of rated power until the end of the Capture phase is only about 0.45, and hence the probability of completing this mission is only 0.45. Figure 2 shows the time-power-probability relation for the sixteen segment radiator which has been used in most of the CANEL studies of one megawatt powerplants. Here the radiator design point is a 0.9 probability of at least 12 of the 16 segments, or 75% of the heat rejection area, surviving to the end of the mission. The power output values indicated by the curves correspond to the integral numbers of radiator segments surviving. 2 references, 2 figures.

20115 (CNLM—4290) Tensile and stress-rupture data for nickel, refractory metals and their alloys. Watson, W.L. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 24 Oct 1962. Contract AC02-84PW02789. 10p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007636.

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The tensile and stress-rupture data presented in this report have been gathered from published reports of outside organizations, information on commercial alloys from various companies, and some CANEL data. The tabulated data are considered to be up to date at the time this report is printed and as accurate as the experimental data reported. These data are for comparison of the me-

chanical properties of various metals and their alloys at elevated temperatures, and is not used as a basis for design calculations. The tabulated data presents the mechanical properties of the metal or alloy in the sheet form. There are a few exceptions from the above which are noted (Example: extrusion, casting, etc.). It should be remembered that some of the data reported represents a relatively few number of tests and should be misleading, because the following information is not complete in all cases: The actual test environment and control of this experiment; the true chemical composition and interstitial content of the material being tested; and the actual fabrication history including the temperature and time of all heat treatments. Short time mechanical properties determined by tensile tests are dependent on the strain-rate used during testing and may not be consistent with all cases in the tabulation. Long time mechanical properties (Creep) or stress-rupture data are usually reported as the 10 h and 100 h rupture stress. These short time data have been extrapulated to obtain the 1000 h and 10,000 h data which is reported in the tabulation.

20116 **(CNLM—4290-Suppl.1) Tensile and stress-rupture data for nickel, refractory metals and their alloys.** Watson, W. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 6 Nov 1962. Contract AC02-84PW02789. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007638.

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Additional data on some of the alloys tabulated in CNLM-4290 are reported in this supplement and supersedes the original data. A Larson-Miller parameter plot of eight commerical refractory alloys is included for easy comparison. The summary of CNLM-4290 also pertains to this supplement. The Larson-Miller Parameter in this report is to be used as a comparison of the following nine commercial alloys whose composition and manufacture are given.

20117 **(CNLM—5233) Termination report of LCRE pump drive motor vibration analysis.** Obringer, R.E. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 29 Aug 1963. Contract AC02-84PW02789. 5p. NTIS, PC A02; 3; GPO Dep. Order Number DE84006943.

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FPS-E-388, Revision 1 defined the specifications for the variable speed of 28 HP electric motors required to drive the LCRE pumps. Paragraph 2.3 of this specification stated the vibration displacement as measured on the motor housing at the bearings. Testing would be done in accordance with section MG 1-424 of NEMA standard. In an effort to determine if motors, which had proven satisfactory as test pump drive motors, would meet the requirements of the above specification, the following tests were conducted. Two motors were tested: AEC S/N 10362 which accummulated 6456.0 operating hours in PT-5A and AEC S/N 10447-1 which had accummulated 82.5 hours in Heat Exchanger Primary Loop and in PT-8. The results of these tests are presented in figures 1 through 4.

20118 **(CNLM—5365-Suppl.1) Fuel irradiation tabulation.** Freed, M.S. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 22 Jan 1964. Contract AC02-84PW02789. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007024.

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The attached tabulation of SNAP 50 and LCRE irradiation tests were compiled and represent the best estimate of data available as of date noted on tabulation. Supplements to this memorandum will be published at intervals to update the available information. If column is blank or contains an asterick (*) no data is available for that item. If zero (0) appears value is below detection limit or code O applies. Please note that burnup for this tabulation is in percent of total uranium fissioned rather than percent of U^{235} fissioned as in CLMN-5365.

20119 **(CNLM—5646) Trip report: BeO properties discussion at General Atomics and Atomics International.** Rowe, G.H. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 16 Apr 1964. Contract AC02-84PW02789. 11p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007038.

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The gist of my conversation with General Atomics and Atomics International is that while their experience with BeO is limited generally to 2000F and below, they are pessimistic about thermal stress resistance under neutron radiation to levels of 10^{20} to 10^{21} and temperatures in the range of 2000F. No evidence was seen to indicate plastic behavior or plastic strain cycling behavior for BeO under these conditions. BeO is regarded as a relatively elastic, brittle material. Experimental tests on unirradiated material confirm this attitude.

20120 **(CNLM—5709-Rev.) Capsule operating summary MTR Cycle No. 204.** Cunniff, C. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 15 Sep 1964. Contract AC02-84PW02789. 5p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007033.

Paper copy only, copy does not permit microfiche production; Declassified 23 Mar 1972.

20121 **(CNLM—5709-Suppl.0) Capsule operating summary MTR Cycle No. 205.** Cunniff, C.; Schmidt, R. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 18 May 1964. Contract AC02-84PW02789. 13p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007034.

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20122 **(CNLM—5709-Suppl.13) Capsule operating summary MTR cycle No. 218.** Cunniff, C. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 21 Jan 1965. Contract AC02-84PW02789. 37p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007115.

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20123 **(CNLM—5709-Suppl.14) Capsule operating summary MTR Cycle No. 219.** Cunniff, C. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 12 Feb 1965. Contract AC02-84PW02789. 39p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007120.

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20124 **(CNLM—5709-Suppl.20) Cycle 225 is the last MTR cycle for which capsule operating data is plotted on a daily basis.** Schmidt, R. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 7 Jul 1965. Contract AC02-84PW02789. 31p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007111.

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20125 **(CNLM—5742) Compatability of fuel with internally lined PWC-11 alloy.** Caplow, S.D.; Doyle, J.R. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 25 Jun 1964. Contract AC02-84PW02789. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007123.

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Based on present knowledge, the solution heat treatment of PWC-11 alloy fuel pins for irradiation must be performed prior to fuel loading. This decision is dictated by: (1) as yet unexplained swelling of the UN-loaded specimens, (2) traces of U metal identified by x-ray fluorescence in the clad and barrier of UN and stoichiometric UC pins and in the barrier of the hyperstoichiometric UC pin, and (3) an excessive amount of carburization of the Ta-liner. Recognition was made of the fact that the alloy will be lacking the strengthening effects of the solution heat-treatment of the area of one end cap weld. However, strengthening of this region by

the end cap itself, confirmed by some tube burst test experience, provides a reasonable basis for expecting satisfactory performance. The test with UN will be repeated in an effort to establish the cause of the swelling and will include a mirco-probe analysis for uranium in the clad. 2 tables.

20126 **(CNLM—5752-Suppl.2) Instrument list.** Gray, W.G. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 22 Jul 1964. Contract AC02-84PW02789. 8p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007110.

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This report contains a list of preferred instrumentation for use in the reactor test facility. Although proven alternate types proposed by the A and E will be considered, specific approval by P and WA-CANEL will be required. Strict adherence to applicable P and WA-CANEL specifications will be required.

20127 **(CNLM—5754-Suppl.5) Review of preliminary investigation of containment vessel response to blast loadign by Walt Summer, December 8, 1964.** Horan, J.J. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 15 Jan 1965. Contract AC02-84PW02789. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007107.

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The referenced CCCo document contains an analysis of a simplified model of a cylindrical containment vessel subjected to an impulse load. Calculations by Summer establish the order of magnitude of the impulse times, loading levels, and resultant stresses as tolerable for the size of accident anticipated. Messrs. Bigelow and Gemma and Miss Hartman were asked to keep abreast of the conceptual work of Catalytic; specifically, (1) Comment on the model and on how any conservative assumptions offset optimistic simplifications. (2) Verify mathematics. (3) Check condition 9 (2.62×10^6 Btu blast) numerically. Mr. Bigelow stated that no alarming discrepancies were found that would drastically alter or eliminate the concept from consideration. He stated a personal preference for single, simple structures as contrasted to that presented where both skin and rebar must unite to support the load. Agreement with Summer's mathematics and arithematic is stated in Gemma's and Hartman's CNLM-5754, Supplement 4. We are also cautioned therein about use of the numerical value of the time at which maximum strain occurs. Comments on the model used are mostly expressions of a desire for detailed investigations. These are in and unpublished plan of attack on the containment vessel design analysis (File No. 674).

20128 **(CNLM—5754-Suppl.13) Blast and missile bibliography.** Horon, J.J. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 26 Jul 1965. Contract AC02-84PW02789. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007140.

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This bibliography lists about 40 reports involving shock waves, shock wave propagation, perforation by missiles and meteoroids, missiles from nuclear explosions, reactor containment studies, accidents, fragmentation and fragment velocity, blast effects, etc.

20129 **(FXM—881) Powerplant heating during start-up.** Kleinman, S.R. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 22 Sep 1954. Contract AC02-84PW02789. 6p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007623.

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In FXM 739, some design assumptions of the powerplant (i.e. reactor plus turbojet) were described. In line with these assumptions, this memo gives a detailed description of the heating procedure used to bring the porweplant to the correct temperature prior to generation of nuclear power. Since the Nak has the lowest melting point, the Nak circuits are filled with the fluid at about 100°F. The Nak is raised in temperature until it reaches 300°F when the Na circuit is filled with the fluid at about 300°F. The heating of the Nak is continued. The Na is heated by the Nak in the Nak-Na heat exchanger. The reactor structure is heated by the Na. When the entire reactor structure reaches a temp. of approximately 1200°F, the barren or partially enriched fluoride salt can be introduced into the reactor without any danger of freezing. The rate at which the temperature of the structure can be raised is limited by the thermal stresses which can be withstood by the materials involved. As yet, there is no number available for the maximum rate at which the temperature can be raised. It is expected that the answer will soon be forthcoming from the Reactor Engineering Group. The amount of heat necessary to raise the temperature of the reactor, Nak piping and radiators 1200°F is 16×10^6Btu. This figure excluded losses by convection and radiation. In FXM 739 and earlier in ths memo, it was stated that the heat will be added to the Nak from an external heat source through which the Nak is circulated. Another method of heating the fluids which has been suggested is the use of the Nak and Na pumps. The advantages of using the pumps are described briefly. 4 figures.

20130 **(FXM—884) Cooling of a control rod.** Sanders, A. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 16 Sep 1954. Contract AC02-84PW02789. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007622.

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Control rod cooling calculations are made for rod surface temperatures of 1300°F (cooling by air or helium) and of 1500°F (cooling by sodium). 2 figures. (LTW)

20131 **(FXM—909) Materials for NaK piping.** Barton, W.W. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 12 Oct 1954. Contract AC02-84PW02789. 2p. (TIM—66). NTIS, PC A02; 3; GPO Dep. Order Number DE84007627.

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Current flexibility and stress analysis of the NaK piping for airborne powerplants have been based on the assumption that the piping material is 316 stainless steel. It has been found that the weight of these piping systems is a sizeable fraction of the entire engine weight. In an effort to reduce piping weight, the practicability of decreasing pipe diameter by increasing NaK velocity is being investigated. A second way to reduce piping weight would be to substitute a stronger material for the 316 stainless steel. With a stronger material the pipe wall thickness could be diminished and still give a pipe strong enough to sustain the bending and twisting moments and the internal pressure. An added advantage from the flexibility standpoint is that the thinner pipe wall would have a lower moment of inertia. There are, of course, many materials stronger than 316 stainless steel in the 1100 to 1500°F temperature range. To be suitable for NaK piping these materials should have the following properties: be weldable, be corrosion resistant in NaK, be oxidation resistant, develop their strength in the weld-affected zone, have adequate ductivity, and be capable of fabrication into thin-walled pipe. In addition, it is believed at this time that not much more than a trace of cobalt is permissible in the NaK piping. The reason for this last requirement is that it is feared that cobalt may be transported around the NaK loop in such a way that it would become radioactive and then deposit in some engine component outside of the reactor shield, thus complicating the engine maintenance problem. Several materials which may very well meet the above requirements have been suggested. They are in order of increasing strength at 1500°F: Hastelloy A; Hastelloy X; Hastelloy B; Nimonic 80; Modified Waspaloy (cobalt replaced with nickel); and Foxaloy.

20132 **(FXM—917) Survey of materials compatability test rigs.** Elovitz, D.M. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 11 Nov 1954. Contract AC02-84PW02789. 5p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007626.

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Since there are many possible schemes for running two materials in sliding contact, a survey of the various schemes which have been employed to establish compatability of materials was authorized. Considerable information which might be of interest in this report must be omitted due to security regulations, but the equipments which are covered do give a good representation of the art. The rigs covered include three Pratt and Whitney Aircraft rigs which have not yet been run, and in fact have not even been com-

pletely designed. The features of the individual rigs are outlined and summarized on a chart which offers a rapid comparison of the various schemes.

20133 **(FXM—978) Reactivity coefficients of interest in the Fireball hazards analysis. Part I.** Merriman, F.C. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 15 Dec 1954. Contract AC02-84PW02789. 5p. (TIM—94). NTIS, PC A02; 3; GPO Dep. Order Number DE84007628.

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In order to evaluate the nuclear hazards associated with operation of a Fireball test reactor, it is necessary to determine the effect on reactivity of the removal or dimensional change of all parts of the reactor system. The results of the first series of multigroup calculations are presented in Part I of this report. The optimum configuration of the Fireball as calculated by NDA was used as a design case. This reactor, Number 773N, was recalculated by Fox to serve as a basis of comparison between various types of circulating fuel reactors which the Advanced Studies Group has under consideration. For purposes of calculation, the geometry was assumed to be spherical. A schematic diagram of the circulating fuel reactor used in the calculations is shown in Figure I. The reactivity coefficients needed for the hazards analysis were calculated using the Advanced Studies Group Multi-group Code, as described in PWAC-542 on page 64. Although the code will handle an unlimited number of groups, it was felt that 17 groups would be sufficient in a calculation of this type. A multi-group calculation was run off on the IBM-701 and iterated until critical. This reactor calculation, Number 104, gave a critical mass of 14.9 kg. of U^{235} when K/sub eff/ $\approx$ 1.0. An unpoisoned reflector was used since current corrosion work indicates that cladding will probably not be required in the beryllium coolant holes. The reactivity coefficient associated with the removal of an item of structure or given change in geometry was determined by calculating the change in neutron multiplication or Δ K/sub eff/ produced. The effect on critical mass of any of the changes studied can be found approximately by using the results of the calculation of the reactivity change associated with a change in fuel concentration. The neutron lifetime or average time between the birth of a neutron and its capture in fission was also determined using the multi-group method.

20134 **(FXM—1002) Additional information on compatability of materials.** Elovitz, D.M. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 7 Jan 1955. Contract AC02-84PW02789. 2p. (TIM—106). NTIS, PC A02; 3; GPO Dep. Order Number DE84007631.

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Further information on materials compatability test results was found in KAPL-986. Discussion with Mr. Ralph Ransom of the Main Plant consulting group revealed that they have found Carboloy 883 superior to Carboloy 44A in their screening work. Carboloy 883 has the same composition as Carboloy 44A, but has a finer grain structure. Investigating this possibility would require the tests listed in addition tho those given in FXM-955.

20135 **(FXM—1011) Approximate method of solution for transient temperature distributions.** Batter, J. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 11 Jan 1955. Contract AC02-84PW02789. 4p. (TIM—110). NTIS, PC A02; 3; GPO Dep. Order Number DE84007635.

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An approximate simple numerical solution for transient temperatures would be of great value for those cases in which the solution of the differential equation for heat flow is either too laborious to evaluate or impossible to find. We consider the case of one dimensional heat flow in rectangular coordinates subjected to an atmosphere whose temperature is an arbitrary function of time.

20136 **(FXM—1014) Preliminary report on the analysis of ^{235}U cross sections.** Corliss, W.R. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 13 Jan 1955. Contract AC02-84PW02789. 3p. (TIM—111). NTIS, PC A02; 3; GPO Dep. Order Number DE84007634.

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Heretofore, the group average ^{235}U cross sections used in multigroup calculations at the Fox Project were Medusa data originated by Oak Ridge National Laboratory and Knolls Atomic Power Laboratory. The publication of new data in BNL-250 and the feasibility of analytically treating the uranium resonance region have made a revision of Medusa data possible. The group averages obtained by these methods are tabulated and compared with corresponding Medusa data. Resonance region values are generally lower in the new data because of the self-protection and better resolution, but occasionally the much higher resonance peaks obtained from the parameters reverses this rule. The new values are usually higher in the pre-resonance region, presumably because of improved data. The new thermal values have been averaged over a Maxwell-Boltzmann distribution and the non-1/v corrections have been employed. Medusa data is not thus corrected. Resonance calculations and group averaging procedures are now being programmed for the IBM 701. In the near future, temperature perturbations for ^{235}U resonances as well as an exhaustive treatment of the resonance structure of other elements will be available.

20137 **(FXM—7228-Suppl.1) Sine-wave boiler tubes correction.** (Pratt and Whitney Aircraft, East Hartford, CT (USA)). May 1965. Contract AC02-84PW02789. 3p. NTIS, PC A02/MF A01; 3; GPO Dep. Order Number DE84007077.

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This report contains to errors in FXM-7228 in mechanical vibrations in boiler tubes.

20138 **(PWAC—176-Rev.) Chemical engine test cell, design criteria.** (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 26 Jun 1957. Contract AC02-84PW02789. 26p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007055.

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Development of the aircraft nuclear engine requires that certain chemical fuel tests be performed before tests on liquid metal are conducted. The proposed test cell is designed for testing an engine on chemical fuel under sea-level-static airflow conditions. The test cell consists of a concrete structure inside which the engine under test will be mounted. Inlet and exhaust chambers will be provided for sound suppression. A control room and lavatory-locker room are elevated above the test area; a window for viewing the test from the control room is provided. The area below the control room will be used for an equipment area and engine preparation area prior to test cell installation. Water spray will be used to cool hot exhaust gases before they enter the exhaust chamber. The design of the test cell and air flow passages is based on a 450 lb/sec size engine and a ratio of 1.5 to 1 secondary to primary air. It is estimated that the total cost of construction for this facility will be $590,000 including 9% government costs.

20139 **(TIM—694) Impile capsule for thermocouple calibration: PW 25 Series.** Butler, E.N. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 22 Jun 1961. Contract AC02-84PW02789. 10p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009908.

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Since a great number of inpile tests are being conducted where temperature is an essential parameter, it is important to determine the accuracy of thermocouples during irradiation. It is further required that accurate and reliable high temperature thermocouples be developed for reactor control system usage. This report covers the design of a lead type inpile capsule for calibration of clad wire thermocouples at elevated temperatures (1760F) during neutron irradiation in the reflector A facilities of the Materials Testing Reactor located at the National Testing Station, Idaho Falls, Idaho. The calibration is based on the freezing point of silver, which is commonly used as a reference point for thermocouples.

20140 **(TIM—706) Valve performance test report.** Gould, G.L. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 1 Nov 1961. Contract AC02-84PW02789. 6p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009792.

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There is a continuing need at CANEL for reliable valves, 3/4" and smaller, to control liquid metal flow in test facilities handling NaK, sodium and potassium at approximately 50 psig and up to 1600°F. The importance of operational reliability in combination with the severe operating conditions has necessitated procuring specially designed valves for each application. In the past three years the cost of a 1/2" valve has decreased from $1200 to $900. During this time, operating experience has been accured which indicates that only minor modifications are required to adapt a standard production valve for this service. A 1/2" model HY-473 valve, as manufactured by Hoke Valve Company, Cresskill, New Jersey, carries a unit price of about $250. Necessary modifications, including addition of an air operator, will cost about $200. By establishing the performance capability of the modified standard production valve, a significant cost reduction can be effected and valve procurement time can be appreciably reduced. It has been demonstrated that the Hoke HY-473 valve is capable of performing satisfactorily in NaK at 1600°F and 50 psig. Disassembly revealed no visible damage to the bellows. The valve is suitable for applications not requiring externally wetted bellows design or high flow coefficient.

20141 **(TIM—713) Inpile capsule for thermocouple calibration: PW 25 30 series.** Butler, E.N. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 23 May 1962. Contract AC02-84PW02789. 11p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009798.

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Since a large number of inpile tests are being conducted where temperature is an essential parameter, it is important to determine the accuracy of thermocouples during irradiation. It is further required that accurate and reliable high temperature thermocouples be developed for reactor control system usage. This report covers the design of a lead type inpile capsule for calibration of clad wire thermocouples at elevated temperatures (1760F) during neutron irradiation in the reflector A facilities of the Materials Testing Reactor located at the National Testing Station, Idaho Falls, Idaho. The calibration is based on the freezing point of silver, which is commonly used as a reference point for thermocouples.

20142 **(TIM—716) Investigation of radiation effects on glass capacitors made by Corning Glass Works of Bradford, Pennsylvania.** Fanciullo, S. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 22 Jun 1962. Contract AC02-84PW02789. 2p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009796.

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As a matter of interest, two capacitors made by Corning Glass Works, Model CY30C-103K, were inserted in the same 48 oz container which housed the speed tranducer experiment, PW-504-4. (Reference TIM-668, Supp. 2). These capacitors consist of layers of ultra stable ribbon glass and aluminum foil with leads attached. The units tested were purchased as having 10,000 mmf +-5% capacitance. The actual measured capacitance was, 9430 mmf on No. 1, and 9480 mmf on No. 2. The value of capacitance measured after exposure to 10^{11} ergs/gm (C) was 9460 mmf on No. 1 and 9530 mmf on No. 2, a change of +0.32% and 0.53%, respectively. It is noted that the value remains within the manufacturers limits of +-5%. The color of the glass envelope changed from clear to bronze. It appears that this type of capacitor has the ability to withstand gamma radiation to a total dose of 10^{11} ergs/gm (C).

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REFER ALSO TO CITATION(S) 19832, 19835

20143 **(DOE/EV—0005-46) Surplus Facilities Management Program. Post remedial action survey report for the Sodium Reactor Experiment (SRE) facility, Santa Susana Field Laboratories, Rockwell International, Ventura County, California.** Wynveen, R.A.; Smith, W.H.; Sholeen, C.M.; Flynn, K.F.; Justus, A.L. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 119p. (ANL-OHS/HP—84-101). NTIS, PC A06/MF A01; GPO Dep. Order Number DE84009123.

Decontamination of the Sodium Reactor Experiment (SRE) began in 1976 and was completed in 1982. In view of the concurrent and post-remedial-action surveys, the following conclusions can be stated. All the buildings and areas included in this decommissioning project have been decontaminated to below the limits specified in the draft ANSI Standard N13.12 and the NRC Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source, or Special Nuclear Material, dated July 1982. Radioactive contamination was found in appropriate access points of the sanitary sewer and storm drain systems included within the boundaries of this decommissioning project. One sample indicated a ^{90}Sr concentration dissolved in the water of approximately half the recommended water concentration for controlled areas and approximately 15 times the recommended water concentration for uncontrolled areas as stated in DOE-5480.1 Chg. 6, Chapter XI. Therefore, the interior inaccessible surfaces of these systems must be considered contaminated in accordance with statements found in the NRC Regulatory Guidelines issued in July 1982. Effluent from the outfall of this drain system must also be considered as being potentially contaminated. 1 reference, 32 figures, 8 tables.

20144 **(DOE/EV/10782—T1) Guidance for training program evaluation.** (Memphis State Univ., TN (USA). Center for Nuclear Studies). Jan 1984. Contract AC01-81EV10782. 51p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007528.

An increased concern about the training of nuclear reactor operators resulted from the incident at TMI-2 in 1979. Purpose of this guide is to provide a general framework for the systematic evaluation of training programs for DOE Category-A reactors. The primary goal of such evaluations is to promote continuing quality improvements in the selection, training and qualification programs.

20145 **(DOE/NV/10327—5) Nevada Test Site Area 25. Radiological survey and cleanup project, 1974-1983. Final report.** McKnight, R.K.; Rosenberry, C.E.; Orcutt, J.A. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). Jan 1984. Contract AC08-84NV10327. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009729.

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This report describes radiological survey, decontamination and decommissioning of the Nevada Test Site (NTS) Area 25 facilities and land areas incorporated in the Nuclear Rocket Development Station (NRDS). Buildings, facilities and support systems used after 1959 for nuclear reactor and engine testing were surveyed for the presence of radioactive contamination. The cleanup was part of the Surplus Facilities Management Program funded by the Department of Energy's Richland Operations Office. The radiological survey portion of the project encompassed portable instrument surveys and removable contamination surveys (swipe) for alpha and beta plus gamma radiation contamination of facilities, equipment and land areas. Soil sampling was also accomplished. The majority of Area 25 facilities and land areas have been returned to unrestricted use. Remaining radiologically contaminated areas are posted with warning signs and barricades. 12 figures.

20146 (EGG—2303) Fuel testing in the power burst facility: a review of methods. Miller, R.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1984. Contract AC07-76ID01570. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009490.

This document presents a description of the Power Burst Facility (PBF) at the Idaho National Engineering Laboratory and briefly describes a number of experimental methods and designs of test trains used in past programs and planned for new programs to study the behavior of light water reactor fuel under conditions ranging from normal to severe accident. The PBF is a thermal reactor with a central 28-cm-diameter, 0.914-m-long through-hole flux-trap for testing purposes. Steady state and transient neutron flux capabilities are described. The reactor has been used in studies of severe fuel damage, operational transients, pellet-cladding interaction, power-cooling-mismatch (burnout and vapor blanketing), loss-of-coolant accident, and extremely fast transients representing reactivity initiated accidents. Test trains developed for these programs range from single-, four-, and nine-rod assemblies, up to the current 32-rod bundles being used for severe fuel damage tests. Test trains and typical instruments are described, as are new test trains and instruments capable of operating near the melting point of UO_2 (3130 K).

20147 (EPRI-NP—2377) BWR refill-reflood program model qualification for BWR safety analysis. Alamgir, M. (General Electric Co., San Jose, CA (USA)). Feb 1984. 265p. (NUREG/CR—2571; GEAP—22049). EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

The calculational capability and analytical models of TRACB02 (a best estimate BWR thermal-hydraulic code) are rigorously tested by performing assessment analysis for twelve separate effects and system effects experiments. These experiments cover a broad range of phenomena observed in several simulated-reactor test facilities and, in one case, a BWR power plant. Comparisons of analyses and experimental data are made for separate effects tests (i.e., tests with most boundary conditions controlled as independent parameters) of two simple vessel blowdowns, two post-dryout bundle heat-ups, and three multidimensional mixing and parallel channel flows. Comparisons are then made for system response tests (i.e., tests showing system transient response to an initiating event) of a one-bundle simulation of a BWR system (the Two-Loop Test Apparatus, TLTA), a 58 bundle simulation of a BWR system (the Steam Sector Test Facility, SSTF) and an actual BWR power plant (Peach Bottom-2). These assessment calculations indicate that TRACB02 correctly predicts governing phenomena and key events observed in these experiments. The analytical models for shear and heat transfer and the phenomenological models for critical flow, two-phase level tracking and upper plenum mixing were generally found to realistically represent the measured LOCA response. Models refinements required for more accurate calculation and identified in this report are water packing, interfacial condensation heat transfer, film boiling heat transfer for large mass flux, entrainment from a two-phase level into a small opening and donor-celling near a subcooled interface.

20148 (EPRI-NP—3411) Recovery of TMI-2 reactor building polar crane. Final report. Graber, J.A. Sr.; Lefkowitz, S. (United States Crane, Inc., Orlando, FL; Pentek, Inc., Coraopolis, PA (USA)). Jan 1984. 212p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

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This report describes the TMI-2 reactor building polar crane, its history both during and after the accident, and the inspections and tests conducted to determine the extent of any damage that occurred. The survivability of key mechanical and electrical components is evaluated. The parts replacement and servicing activities performed to return the crane to a useable condition are reported. The experience at TMI-2 is used to formulate recommendations for other plants that might encounter accident conditions such as occurred at TMI-2. The recommendations are for mitigation of the extent of damage and loss of availability which would be important because use of the reactor building polar crane would be on the critical path for recovery from such an accident.

20149 (FXM—931) Total activity of fission products and NaK in the fireball. Davis, H. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 11 Nov 1954. Contract AC02-84PW02789. 8p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007618.

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In the event of a reactor failure, the liquid components of the system (the liquid fuel and the liquid metal coolants) are the materials most likely to escape from the reactor shield. A knowledge of the total reactivities contained in these components is of interest, therefore, in the analysis of reactor hazards for safeguard purposes. The total activity of the fission products contained in the liquid fuel and the total activity induced in the NaK circulating throught the heat exchanger have been calculated as a function of time after the reactor become subcritical. The calculations assume a standard fireball configuration operating at a power level of 150 MW. Three different histories of reactor operations are considered: (1) steady operation for 500 hours, (2) steady operation for 24 hours, and (3) on-off operation (on 24 hours and off 24 hours) for 21 days = 524 hours. A comparison of the NaK and fission product activities shows that at shut down time, the fission product activity will be greater by a factor of 5×10^4. In addition the fission product activity has a longer life time. The NaK activity is down by a factor of 10^3 within four days after shut down. It would take two weeks for the fission product activity to be reduced by the same factor if the reactor had been operating for 24 hours; over three years would be required if the reactor had been operating for 500 hours. Evidently then the accidental release of the fluid fuel would be a much more serious incident than the release of the NaK. The activity quoted above (3×10^{19} mev/sec) for the fission products is equivalent to a billion curies. If this activity were spread uniformly on the ground over a circular area 60 miles in diameer, a person in the area three hours after the incident would receive a radioactive dose at the rate of 1 REM/hour. For the radioactive NaK the diameter of the region would be 0.6 miles for the same dose. 3 figures..

20150 (HEDL-SA—2841) Experience with nonuniform damping in the seismic analysis of nuclear plant components. Winkel, B.V.; Julyk, L.J. (Hanford Engineering Development Lab., Richland, WA (USA)). Jan 1983. Contract AC06-70FF02170. 29p. (CONF-830607—33). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84003949.

From American Society of Mechanical Engineers pressure vessel and piping conference; Portland, OR, USA (19 Jun 1983).

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Individual components of nuclear power plants may exhibit pronounced differences in damping magnitude. Various methods for accounting for nonuniform damping in a structural model are reviewed and evaluated. The methods are compared by solving a beam/pipe model subjected to a typical seismic ground motion. A two-degree-of-freedom variable damping parameter study is also presented. Based upon the experience of evaluating and applying the available methods, application guidelines are presented.

20151 (IAE—3586/5) Calculation technique for loss of coolant accidents. Sulkhanishvili, N.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 60p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700762.

Microfiche only, copy does not permit paper copy reproduction9 refs.; 13 figs.

A calculation technique for loss of coolant accidents in primary circuit of an NNP with WWER type reactors, when leakage rates exceed the capacity of make-up systems, is suggested. The technique makes possible to analyse both limit and intermediate loss of coolant accidents. Some computational results obtained by means of "ART-03" program, implementing the above technique, are presented.

20152 **(IAEA-TECDOC—294) International experience in the implementation of the lessons learned from the Three Mile Island incident.** (International Atomic Energy Agency, Vienna (Austria)). Aug 1983. 271p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84700763.

This document consists of two parts and an Appendix. Part I provides a summary of worldwide experiences and subsequent recommendations regarding the implementation of the Three Mile Island-Unit 2 incident lessons learned. Part II gives in a summary fashion, specific responses and actions of the mentioned countries and international organizations as categorized into ten (10) subject areas. The Appendix, on the other hand, contains examples of the experiences of Brazil, Germany (F.R.), Hungary, and the Philippines, on the implementation of TMI lessons learned. This document should be useful to countries with nuclear power development programmes in that it provides a means for comparison of their actions with others. For countries which are embarking on their first nuclear power project, the document should provide a useful reference for specific TMI-related issues that need to be considered in their nuclear programmes.

20153 **(JAERI-M—82-168) Evaluation of the RETRAN code in ATWS analysis of BWR.** Yoshida, Kazuo. (Japan Atomic Energy Research Inst., Tokyo). Nov 1982. 45p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700770.

An analysis of the ATWS (Anticipated Transient without Scram) in a BWR plant has been performed. The main objective of this analysis is to assess the analytical capability of the RETRAN Code upon the ATWS and to better understand the thermal-hydraulic behavior of a BWR plant in an ATWS. Four types of ATWS, such as main steam isolation valve closure without scram, were analyzed. In addition to these cases, sensitivity studies were performed to study effects of some key factors (i.e. gap conductance, trip of recirculation pump, DNB). In the course of this study, it was found that the RETRAN is a suitable code for an analysis of ATWS in a BWR plant, and that trip of the recirculation pump would play an important role in mitigating the consequence of ATWS.

20154 **(JAERI-M—82-184) Evaluation of symbiotic energy system between gas-cooled fast breeder reactor (GCFR) and multi-purpose very high temperature reactor (VHTR), (4). GCFR transient analysis and safety performance evaluation.** Iijima, Susumu; Yoshida, Hiroyuki; Tanaka, Ryokichi; Niguma, Yoshinori; Kobayashi, Takeshi. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 54p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700764.

The conceptual design study of 1000 MWe gas-cooled fast breeder reactor (GCFR), which is used in the GCFR-VHTR symbiotic energy system, has been performed. In this report, the transient response of the GCFR core to accident events has been analyzed and safety performance of the 1000 MWe GCFR has been evaluated considering the analyses. A depressurization accident caused by failure of a primary coolant system and a reactivity insertion accident due to withdrawal of a control rod have been analyzed using nuclear and thermo-hydraulic coupled program MR-X developed for kinetics analysis of gas-cooled fast breeder reactors. The maximum fuel and cladding temperatures are most important problem to be analysed during a trangient of a gas-cooled fast breeder reactors. The analyses show that reliable reactor shutdown and emergency cooling systems are most important to achieve successful cold shutdown well before leading to core damage and also that no severe failures of fuel pin and cladding occures by working above mentioned safety systems well during the accidents.

20155 **(NUREG—0675-Suppl.22) Safety evaluation report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323). Suppl. 22.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Mar 1984. 429p. NTIS, PC A19/MF A01 - GPO $11.00. Order Number DE84901017.

Supplement 22 to the Safety Evaluation Report for Pacific Gas and Electric Company's application for licenses to operate Diablo Canyon Nuclear Power Plants, Unit 1 and 2 (Docket Nos. 50-275 and 50-323), has been prepared jointly by the Office of Nuclear Reactor Regulation and the Region V Office of the US Nuclear Regulatory Commission. This supplement provides the criteria that were used by the staff to determine which of the allegations that have been evaluated and must be resolved prior to Unit 1 achieving criticality and operating at power level up to 5 percent of rated power (i.e., low power operation). The supplement also reports on the status of the staff's investigation, inspection and evaluation of 219 allegations or concerns that have been identified to the NRC as of March 9, 1984, excluding those recently received under 10 CFR 2.206 petitions.

20156 **(NUREG—1022-Suppl.1) Licensee Event Report system. Description of system and guidelines for reporting. Suppl. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Feb 1984. 55p. NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84901029.

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On July 26, 1983, the Commission published in the Federal Register a final rule (10 CFR 50.73) that modified and codified the Licensee Event Report (LER) system. The rule became effective on January 1, 1984. In September 1983, the NRC published NUREG-1022 which provides supporting information and guidance that is of interest to persons responsible for the preparation and review of LERs. The information contained in NUREG-1022 includes: (1) a brief description of how LERs are analyzed by the NRC, (2) a restatement of the guidance contained in the Statement of Consideration that accompanied the publication of the LER rule, (3) a set of examples of potentially reportable events with staff comments on the actual reportability of each event, (4) guidance on how to prepare an LER, including the LER forms, and (5) guidance on submittal of LERs. Subsequently, during the period from October 25, 1983 to November 16, 1983, the NRC staff held five regional meetings to discuss the scope and content of the LER rule with utility and NRC regional representatives. During these meetings numerous questions arose and were answered. This supplement to NUREG-1022 contains a summary of the questions asked and the answers given.

20157 **(NUREG/CR—1706) Subsystem response review. Seismic Safety Margins Research Program.** Kennedy, R.P.; Campbell, R.D.; Wesley, D.A.; Kamil, H.; Gantayat, A.; Vasudevan, R. (Engineering Decision Analysis Co., Inc., Palo Alto, CA (USA)). Feb 1981. Contract W-7405-ENG-48. 287p. (UCRL—15216). NTIS, PC A13/MF A01; 1 - GPO; GPO Dep. Order Number DE84009186.

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A study was conducted to document the state of the art in seismic qualification of nuclear power plant components and subsystems by analysis and testing and to identify the sources and magnitude of the uncertainties associated with analysis and testing methods. The uncertainties are defined in probabilistic terms for use in probabilistic seismic risk studies. Recommendations are made for the most appropriate subsystem response analysis methods to minimize response uncertainties. Additional studies, to further quantify testing uncertainties, are identified. Although the general effect of non-linearities on subsystem response is discussed, recommendations and conclusions are based principally on linear elastic analysis and testing models.

20158 **(NUREG/CR—2000-Vol.3-No.2) Licensee Event Report (LER) compilation for month of February 1984. Vol. 3, No. 2.** (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 166p. (ORNL/NSIC—200-Vol.3-No.2). NTIS, PC A08/MF A01 - GPO; GPO Dep. Order Number DE84009502.

This monthly report contains LER operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during this period. The LER summaries are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries.

20159 **(NUREG/CR—2331-Vol.3-No.2) Safety research programs sponsored by Office of Nuclear Regulatory Research. Volume 3. No. 2. Quarterly progress report, April 1-June 30, 1983.** Bari, R.A.; Cerbone, R.J.; Ginsberg, T.; Greene, G.A.; Guppy, J.G.; Hall, R.E.; Luckas, W.J. Jr.; Reich, M.; Saha, P.; Sastre, C. (Brookhaven National Lab., Upton, NY (USA)). Sep 1983. Contract AC02-76CH00016. 157p. (BNL-NUREG—51454-Vol.3-No.2). NTIS, PC A08/MF A01 - GPO; GPO Dep. Order Number DE84008056.

The projects reported are the following: HTGR Safety Evaluation, SSC development, Validation and Application, CRBR balance of plant modeling, thermal-hydraulic reactor safety experiments, LWR plant analyzer development, LWR code assessment and application, thermal reactor code development (RAMONA-3B); stress corrosion cracking of PWR steam generator tubing, bolting failure analysis, probability based load combinations for design of category I structures, mechanical piping benchmark problems; human error data for nuclear power plant safety related events, criteria for human engineering regulatory guides and human factors in nuclear power plant safeguards.

20160 **(NUREG/CR—3359-Vol.4) Physics of reactor safety. Quarterly report, October-December 1983. Vol. IV.** (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 23p. (ANL—83-11-Vol.4). NTIS, PC A02/MF A01 - GPO; GPO Dep. Order Number DE84008285.

The work in the Applied Physics Division includes reports on reactor safety modeling and assessment by members of the Reactor Safety Appraisals Section. Work on reactor core thermal-hydraulics is performed in ANL's Components Technology Division, emphasizing 3-dimensional code development for LMFBR accidents under natural convection conditions.

20161 **(NUREG/CR—3621) Safety system status monitoring.** Lewis, J.R.; Morgenstern, M.H.; Rideout, T.H.; Cowley, P.J. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 128p. (PNL—4832). NTIS, PC A07/MF A01 - GPO $5.50; GPO Dep. Order Number DE84009496.

The Pacific Northwest Laboratory has studied the safety aspects of monitoring the preoperational status of safety systems in nuclear power plants. The goals of the study were to assess for the NRC the effectiveness of current monitoring systems and procedures, to develop near-term guidelines for reducing human errors associated with monitoring safety system status, and to recommend a regulatory position on this issue. A review of safety system status monitoring practices indicated that current systems and procedures do not adequately aid control room operators in monitoring safety system status. This is true even of some systems and procedures installed to meet existing regulatory guidelines (Regulatory Guide 1.47). In consequence, this report suggests acceptance criteria for meeting the functional requirements of an adequate system for monitoring safety system status. Also suggested are near-term guidelines that could reduce the likelihood of human errors in specific, high-priority status monitoring tasks. It is recommended that (1) Regulatory Guide 1.47 be revised to address these acceptance criteria, and (2) the revised Regulatory Guide 1.47 be applied to all plants, including those built since the issuance of the original Regulatory Guide.

20162 **(NUREG/CR—3622) Probabilistic model of annular-dispersed flow in a reactor subchannel as seen by cylindrical geometry impedance probes.** Allgood, G.O.; Roberts, M.J. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 58p. (ORNL/TM—8841). NTIS, PC A04/MF A01 - GPO; GPO Dep. Order Number DE84006893.

Thesis. Submitted to University of Tennessee, Knoxville.

A probabilistic model of annular-dispersed flow in a reactor subchannel as seen by cylindrical geometry impedance probes is developed from a finite-element model of these electrodes in an inhomogeneous, isotropic medium of water and steam. The model is based on a derived finite-difference equation for the potential at the center of a cube in terms of the potentials of the adjacent cubes and their material properties (Ampere's circuital law, low-frequency case). The probabilistic model returns admittance (or capacitance) signals for two sets of probes based on specified film and two-phase void fractions. These signals will have temporal variations based on the flow velocities, the probe separation distance, and the frequency content of signals. The model assumes one-dimensional flow.

20163 **(NUREG/CR—3628) Probability based safety checking of nuclear plant structures.** Ellingwood, B. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Dec 1983. Contract AC02-76CH00016. 81p. (BNL-NUREG—51737). NTIS, PC A05/MF A01 - GPO; GPO Dep. Order Number DE84009543.

This report describes the basis for the development of practical probability-based design criteria for nuclear plant structures. A brief critical review of existing criteria is provided to highlight desirable features of probability based safety checking. A specific deterministic design criteria format is then recommended. Finally, the selection of a set of structures to test the validity of the probability-based checking equations is described. Statistical data on structural loads are summarized in an appendix.

20164 **(SAND—83-2018C) Effect of aging on EPR cable electrical performance during LOCA simulations.** Bustard, L.D. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-840516—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006721.

From International symposium on aging in tests of safety equipment for nuclear power plants; Paris, France (15 May 1984).

When exposed to a LOCA environment, some ethylene propylene rubber (EPR) cable materials experience substantial moisture absorption and dimensional changes. These phenomena may contribute to mechanical damage of the cable insulation resulting in electrical degradation. Recent experiments illustrate that the extent of moisture absorption and dimensional changes during an accident simulation are dependent on the EPR product, the accelerated age, and the aging technique employed to achieve that age. Results for several commercial EPR materials are summarized.

20165 **(UCRL—86249) Failure probability of PWR reactor coolant loop piping.** Lo, T.; Woo, H.H.; Holman, G.S.; Chou, C.K. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 17p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009540.

This paper describes the results of assessments performed on the PWR coolant loop piping of Westinghouse and Combustion Engineering plants. For direct double-ended guillotine break (DEGB), consideration was given to crack existence probability, initial crack size distribution, hydrostatic proof test, preservice inspection, leak detection probability, crack growth characteristics, and failure criteria based on the net section stress failure and tearing modulus stability concept. For indirect DEGB, fragilities of major component supports were estimated. The system level fragility was then calculated based on the Boolean expression involving these fragilities. Indirect DEGB due to seismic effects was calculated by convolving the system level fragility and the seismic hazard curve. The results indicate that the probability of occurrence of both direct and indirect DEGB is extremely small, thus, postulation of DEGB in design should be eliminated and replaced by more realistic criteria.

20166 **Assessment of TRAC-PF1 and RELAP5/MOD1 codes with GE large vessel blowdown test.** Jo, J.H. (Brookhaven National Laboratory Upton, NY 11973). *Transactions of the American Nuclear Society;* **45**: 875-876(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20167 **Erosion of steel structures by high-temperature melts.** Powers, D.A. (Sandia National Laboratories P.O. Box 5800 Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **45**: 855-856(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

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20246 **Comparison of methods for propagation of uncertainties through large fault trees.** Campbell, K.; Beckman, R.J.; Booker, J.M.; Martz, H.F.; Whiteman, D.E. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **45**: 328-329(Oct 1983). (CONF-831047—).

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20250 **Probabilistic risk analysis methods applied to plant technical specifications.** Vesely, W.E. (Battelle Columbus Laboratories, 505 King Avenue, Columbus, OH 43201). *Transactions of the American Nuclear Society;* **45**: 332(Oct 1983). (CONF-831047—).

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20255 **Subcriticality measurements for a fuel solution tank with changing fuel concentration using ^{252}Cf-source-driven neutron noise analysis.** Mihalczo, J.T.; Blakeman, E.D.; Johnson, E.B.; King, W.T. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **45**: 337(Oct 1983). (CONF-831047—).

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20259 **Nuclear criticality emergency planning at Lawrence Livermore National Laboratory.** Barnett, C.S. (Lawrence Livermore National Lab., P.O. Box 808, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **45**: 342-343(Oct 1983). (CONF-831047—).

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20265 **Design and evaluation of decision aids for operators.** Rouse, W.B. (Search Technology, Inc., 25B Technology Park/Atlanta Norcross, GA 30092). *Transactions of the American Nuclear Society;* **45**: 357-358(Oct 1983). (CONF-831047—).

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20273 **Availability of high-pressure safety injection system in PWRs.** Sun, Y.U.; Fresco, A.; Papazoglou, I.A. (Brookhaven National Laboratory, Upton, New York 11973). *Transactions of the American Nuclear Society;* **45**: 374-376(Oct 1983). (CONF-831047—).

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20287 **GAP-4 molten-fuel intersubassembly gap drainage experiment: results and analysis.** Spencer, B.W.; Sienicki, J.J.; Vetter, D.; Wesel, R. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **45**: 394-395(Oct 1983). (CONF-831047—).

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20294 **Monitoring the radiation worker: an architectural engineer's approach.** Chin, P.U.W.; Driscoll, M.L. (Stone & Webster Engineering Corp., P.O. Box 2325, 245 Summer Street, Boston, MA 02107). *Transactions of the American Nuclear Society;* **45**: 598-599(Oct 1983). (CONF-831047—).

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20295 **A radiological records management system for a DOE program to decontaminate multiple sites managed from a central office.** Walker, E. (Bechtel National Inc., P.O. Box 350, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **45**: 599-601(Oct 1983). (CONF-831047—).

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20296 **Regulatory perspectives on the temporary work force.** Congel, F. (U.S. Nuclear Regulatory Commission, Washington, DC 20555). *Transactions of the American Nuclear Society;* **45**: 601-602(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20297 **Implementation of a nuclear employee data system (NEDS).** Haskins, E.W. (Edison Electric Institute, 1111 19th Street, N.W., Washington, DC 20036). *Transactions of the American Nuclear Society;* **45**: 602(Oct 1983). (CONF-831047—).

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20298 **ALARA aspects of sleeving steam generators.** Wylie, H.R. (Westinghouse Electric Corp. Nuclear Services Division, P.O. Box 2728, Pittsburgh, PA 15320). *Transactions of the American Nuclear Society;* **45**: 614-615(Oct 1983). (CONF-831047—).

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20299 **Radiation levels due to crud deposition in boiling water reactors.** Barcomb, D.; Hazzan, M.J.; Irving, T.; Stocknoff, M.S. (Niagra Mohawk Power Corp., 300 Erie Boulevard, West Syracuse, NY 13202). *Transactions of the American Nuclear Society;* **45**: 615-616(Oct 1983). (CONF-831047—).

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20300 **Modeling the TMI-2 reactor radiation source before removing the head.** Fricke, R.; Peterson, H.K. (Burns & Roe, Inc., Three Mile Island Nuclear Station, P.O. Box 480, Middletown, PA 17057). *Transactions of the American Nuclear Society;* **45**: 618-619(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20301 **The role of the STA at the Palo Verde nuclear generating station.** Self, J. (Arizona Public Service Co., P.O. Box 21666, Phoenix, AZ 85036). *Transactions of the American Nuclear Society;* **45**: 631-632(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20302 **Monitoring of transient workers: The insurance viewpoint.** Forbes, J.L. (American Nuclear Insurers, 270 Farmington Avenue, Farmington, CT 06032). *Transactions of the American Nuclear Society;* **45**: 601(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

25 ENERGY STORAGE

2501 Magnetic

20303 **(LA-UR—84-52) Plant and operational features of the BPA 30 MJ superconducting magnetic energy storage system.** Rogers, J.D.; Hauer, J.F. (Los Alamos National Lab., NM (USA); USDOE Bonneville Power Administration, Portland, OR). 1984. Contract W-7405-ENG-36. 7p. (CONF-840515—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006006.

From International symposium and workshop on dynamic duties of energy storage plants; Boston, MA, USA (7 May 1984).

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A 30 MJ superconducting magnetic energy storage (SMES) system was designed and developed for application in the Western US Power System to damp power oscillations that limit high voltage ac transmission. The system is in place at the Bonneville Power Administration (BPA) Tacoma Substation and has been in an experimental use for over a year. Extended operations of the unit have been undertaken with success. The physical, electrical, and operational features of the SMES system are given.

20304 **Improved numerical modeling of rock masses through geostatistical characterization.** La Pointe, P.R. (Univ. of Wisconsin, Madison). pp 416-421 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—).

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

As part of an overall site investigation and design program for cavern construction of a prototype superconductive magnetic energy storage (SMES) unit in Wisconsin, a series of finite element simulations using conventional and Turing Bands approaches was undertaken. The purpose of these simulations was to improve numerical modeling forecasts of cavern stability by examining and incorporating spatial correlation, thus reducing uncertainty in design and cost estimating.

2502 Compressed Gas

20305 **Studies of the Mount Simon Sandstone as a potential storage reservoir for compressed air.** Pincus, H.J. (Univ. of Wisconsin, Milwaukee). pp 156-161 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—).

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

The storage of off-peak power in electrical power systems can be accomplished by (1) charging aquifer-caprock systems with with heated compressed air when generating capacity exceeds demand and (2) discharging air during periods of peak-power demand. Changes in rock properties after thousands of charge-discharge cycles must be considered in selection, design and operation of such energy-storage facilities. Laboratory studies have been conducted since 1977 to provide data that can be used to design and conduct field tests, and ultimately to establish procedures and criteria for identifying and evaluating suitable sites for storage of compressed air in porous, permeable rocks, and to develop monitoring systems for operational Compressed Air Energy STorage (CAES) installations. Some of the results obtained are relevant also to cavern storage and to other applications involving the flow and storage of fluids in rock. This paper presents some of the results obtained during FY 1980 from studies of laboratory ventilation of the Mt. Simon Sandstone, using a complete analysis-of-variance matrix (Pincus, 1980b).

2509 Batteries

REFER ALSO TO CITATION(S) 20503, 20563

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 19667, 19677, 20335, 20357

20306 **(EUR—8459-EN) EFOM 12C case studies. Candidate technologies in the European energy systems: United Kingdom case study.** Littlechild, S.C.; Morris, J.L.; Vaidya, K.G. (Commission of the European Communities, Luxembourg). 1983. 40p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The EFOM 12C model is used to assess the potential contribution of some new energy technologies for the UK. Cost and demand assumptions are reviewed and constraints on nuclear electricity capacity and assumptions on demand for energy and industrial output are modified to reflect recent revisions of energy projections. Choice of new technologies included in the model is based on an Energy Technology Support Unit assessment. The technologies included are conservation, synthetic natural gas, synthetic natural oil, FBR, pressurised fluidised bed combustion, wave and wind power and CHP.

20307 **(PB—84-136563) Critical assessment of the first results of the EFOM 12C model. Final report.** Thonet, C.; Van der Voort, E.; Love, P.; Jadot, P. (Commission of the European Communities, Luxembourg). 1984. 144p. (EUR—8292-EN). NTIS, PC E07/MF E07.

EFOM 12C is intended to model the development and utilization of energy in the European Community for the next forty years. While the actual outcome of energy utilization is totally dependent on human decisions, it was considered to be valuable to model energy development, demand, and utilization for five scenarios. They were:- (a) 'reference case' in which overall costs were minimized, (b) 'mining case' in which imports were minimized, (c) 'decay' where the costs of production were minimized but with no other constraints, (d) 'autonomous case' with import costs limited within an overall cost constraint, and (e) 'dependency case' in which the investment costs were minimized within an overall cost constraint.

2902 Economics And Sociology

20308 **(FWS/OBS—83/14-Vol.1) Florida coastal ecological characterization: a socioeconomic study of the southwestern region. Volume I. Text.** French, C.O.; Parsons, J.W. (eds.). (Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team). Aug 1983. 342p. US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458.

Data are compiled from existing sources on the social and economic characteristics of the southwestern coastal region of Florida, which is made up of Charlotte, Collier, DeSoto, Hillsborough, Lee, Manatee, Monroe, Pasco, Pinellas, and Sarasota Counties. Described are the components and interrelationships among complex processes that include population and demographics characteristics, mineral production, multiple-use conflicts, recreation and tourism, agricultural production, sport and commercial fishing, transportation, industrial and residential development, and environmental issues and regulations. Energetics models of socioeconomic systems are also presented. 43 figures, 98 tables.

20309 **(FWS/OBS—83/15-Vol.1) Florida coastal ecological characterization: a socioeconomic study of the northwestern region. Volume I. Text.** French, C.O.; Parsons, J.W. (eds.). (Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team). Aug 1983. 326p. US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458.

Data are compiled from existing sources on the social and economic characteristics of the Northwestern coastal region of Florida, which is made up of Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, and Franklin Counties. Described are the components and interrelationships among complex processes that include population and demographics characteristics, mineral production, multiple-use conflicts, recreation and tourism, agricultural production, sport and commercial fishing, transportation, industrial and residential development, and environmental issues and regulations. Energetics models of socioeconomic systems are also presented. 40 figures, 108 tables.

20310 **(NP—4770191) Effects of energy price increases on the competitive power of energy-intensive productions of German industry.** Gebhardt, A. (Ifo-Institut fuer Wirtschaftsforschung, Muenchen (Germany, F.R.)). 1983. 329p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84770191.

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Inspite of the changed framework conditions caused by the enormous increase of petroleum prices the F.R. of Germany has been able to maintain its international competitive position. However, it can not be expected that the factors favouring German exports shall have a lasting effect. This as well as the fact that the price of a ton of imported petroleum has increased by another 122% from 1978-1981 presents us with the question of whether the economic system shall be able to bear further energy cost burdens and what consequences are connected herewith. The answer is to be an orientation aid for future energy-political measures for the solution of problems concerning the adaptation of economy to changed structures.

20311 **(NP—4900387) Texas natural gas tax structure alternatives: implications and impacts.** (Texas Governor's Energy Advisory Council, Austin (USA)). 1 Apr 1976. 34p. NTIS, PC A03/MF A01. Order Number DE84900387.

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An overview of Texas oil and gas production, prices, and state revenues are tabulated. Also included are consumer rates and consumption data for natural gas and electricity. Information is given for the years 1952 through 1975, as available.

20312 **(NP—4900390) Selected Texas and US refinery data: taxes, operating costs, capacity, prospects for growth and other information relevant to refinery tax considerations.** Holloway, M.L.; White, D.; Clemons, O. (Texas Governor's Energy Advisory Council, Austin (USA). Forecasting and Policy Analysis Div.). 23 Mar 1977. 32p. NTIS, PC A03/MF A01. Order Number DE84900390.

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This report provides selected background information relevant to the refinery tax question, but does not discuss economic impacts or the appropriateness of the tax in Texas. The design of tax structures for state and local revenues is a complex matter involving not only technical and legal questions but questions of stability of tax sources, economic effects of the distribution of tax loads among industries and among consumer groups, questions of equity and many others. The consideration of imposing a refinery tax on Texas refining operations is not exception and this report attempts to recognize such complexities.

20313 **(WRDC—15) Energy development: initial effects on government revenues.** Stinson, T.F.; Voelker, S.W. (Economic Research Service, Washington, DC (USA). Economic Development Div.). Dec 1982. 43p. NTIS, PC A03/MF A01. Order Number DE84900853.

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Energy development can cause shortrun financial problems for local governments. Although such development produces some additional tax revenues, these revenues are usually much lower during early development stages than after the energy-producing operation begins. This creates an early shortrun imbalance between government revenues and expenditures. State and federal loans, impact aid for operating expenses, and grants ease such financial problems. The ENERGYTAX simulation model is used to illustrate this problem, tracing the time-path of new local revenues from a

coal mine, an electric generating plant, and a combination of the two for developments in Montana, North Dakota, and Wyoming.

20314 **(FWS/OBS—83/14-Vol.2-Pt.1) Florida coastal ecological characterization: a socioeconomic study of the southwestern region. Volume II. Data appendix, Part 1.** French, C.O.; Parsons, J.W. (eds.). (Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team). Aug 1983. 317p. US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458.

Data are compiled from existing sources on the social and economic characteristics of the southwestern coastal region of Florida, which is made up of Charlotte, Collier, DeSoto, Hillsborough, Lee, Manatee, Monroe, Pasco, Pinellas, and Sarasota Counties. Described are the components and interrelationships among complex processes that include population and demographics characteristics, mineral production, multiple-use conflicts, recreation and tourism, agricultural production, sport and commercial fishing, transportation, industrial and residential development, and environmental issues and regulations. Energetics models of socioeconomic systems are also presented. This volume contains appendices presenting data on population, employment, income, health services, agriculture, fish and game, and industrial development. 9 figures, 246 tables.

20315 **(FWS/OBS—83/14-Vol.2-Pt.2) Florida coastal ecological characterization: a socioeconomic study of the southwestern region. Volume II. Data appendix, Part 2.** French, C.O.; Parsons, J.W. (eds.). (Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team). Aug 1983. 374p. US Fish and Wildlife, NCET, 1010 Gause Blvd., Slidell, LA 70458.

Data are compiled from existing sources on the social and economic characteristics of the southwestern coastal region of Florida, which is made up of Charlotte, Collier, DeSoto, Hillsborough, Lee, Manatee, Monroe, Pasco, Pinellas, and Sarasota Counties. Described are the components and interrelationships among complex processes that include population and demographics characteristics, mineral production, multiple-use conflicts, recreation and tourism, agricultural production, sport and commercial fishing, transportation, industrial and residential development, and environmental issues and regulations. Energetics models of socioeconomic systems are also presented. This volume contains appendices presenting data on land use, public utilities, transportation, recreation and tourism. 21 figures, 141 tables.

20316 **(FWS/OBS—83/14-Vol.2-Pt.3-App.) Florida coastal ecological characterization: a socioeconomic study of the southwestern region. Volume II. Data appendix, Part 3.** French, C.O.; Parsons, J.W. (eds.). (Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team). Aug 1983. 210p. US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458.

Data are compiled from existing sources on the social and economic characteristics of the southwestern coastal region of Florida, which is made up of Charlotte, Collier, DeSoto, Hillsborough, Lee, Manatee, Monroe, Pasco, Pinellas, and Sarasota Counties. Described are the components and interrelationships among complex processes that include population and demographics characteristics, mineral production, multiple-use conflicts, recreation and tourism, agricultural production, sport and commercial fishing, transportation, industrial and residential development, and environmental issues and regulations. Energetics models of socioeconomic systems are also presented. This volume contains appendices presenting data on mineral and oil production, and environmental issues and regulations. 255 references, 20 figures, 91 tables.

20317 **(FWS/OBS—83/15-Vol.2-Pt.1) Florida coastal ecological characterization: a socioeconomic study of the northwestern region. Volume II. Data appendix, Part 1.** French, C.O.; Parsons, J.W. (eds.). (Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team). Aug 1983. 330p. US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458.

Data are compiled from existing sources on the social and economic characteristics of the Northwestern coastal region of Florida, which is made up of Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, and Franklin Counties. Described are the components and interrelationships among complex processes that include population and demographics characteristics, mineral production, multiple-use conflicts, recreation and tourism, agricultural production, sport and commercial fishing, transportation, industrial and residential development, and environmental issues and regulations. Energetics models of socioeconomic systems are also presented. This volume contains appendices presenting data on populations, employment, health services, agriculture, fish and game, industrial and residential development, and land use. 18 figures, 239 tables.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 19646, 20308, 20309, 20316, 20333, 20753, 20755, 20756, 20867, 20868, 20869, 20870

20318 **(NP—4770183) Economic growth versus preservation of the environment.** Buhl, H.U. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Wirtschaftstheorie und Operations Research). 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770183.

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A discrete model of an economy is formulated, discussed and analyzed. Contrary to most of the literature on the theory of economic growth it is assumed that the society is not purely consumption maximizing. Thus, environmental considerations are integrated into the society's objective function. Using dynamic programming methods, explicit optimal investment policies for the economy are determined.

20319 **(OTA-M—82-Vol.1) Analysis of laws governing access across federal lands. Options for access in Alaska. Vol. 1.** (Office of Technology Assessment (U.S. Congress), Washington, DC). 1982. 259p. NTIS, PC A12/MF A01. Order Number DE84900018.

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This report contains information derived from an Office of Technology Assessment (OTA) assessment of the effects of federal laws, policies, and practices on access through federal to non-federal lands. It makes available the results of an analysis of the issues associated with the legal aspects of access, and presents a range of options dealing with access through Alaska lands. The information contained in this report is relevant to congressional deliberations about Alaska lands called for by section 17(d)(2) of the Alaska Native Claims Settlement Act (ANCSA), and particularly to the use of Alaska conservation lands for purposes of access to non-federal mineral-bearing lands. This report focuses on two topics: the access provisions of federal laws, and options for congressional consideration that deal with the process of obtaining access across federal lands in Alaska.

20320 **(OTA-M—82-Vol.2) Analysis of laws governing access across federal lands. Options for access in Alaska. Working papers. Volume II.** (Office of Technology Assessment (U.S. Congress), Washington, DC). 1982. 318p. NTIS, PC A14/MF A01. Order Number DE84900017.

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This report contains working papers commissioned by the Office of Technology Assessment as part of an analysis of the federal laws, policies, and practices affecting access through federal to non-federal mineral-bearing lands. The analysis deals only with access to on-shore, non-fuel minerals and focuses especially on Alaska.

2904 Natural Resources

REFER ALSO TO CITATION(S) 20309, 20316

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 19870, 19917, 19981, 20417

20321 **(CONF-7804213—1) Environmental research plans and priorities of the Department of Energy.** Lewis, R.A. (USDOE Assistant Secretary for Environment, Washington, DC). 1978. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009389.

From 7. annual conference of the National Association for Environmental Education; Chicago, IL, USA (30 Apr 1978).

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This lecture discusses the problems and opportunities for federal research on energy and the environment in the organizational structure and goals of the Department of Energy.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 19730, 19776, 19777, 19783, 20753

20322 **(CNLM—3938) Drum drive motor environment (PWAR-16).** Shiembob, L.T. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 27 Dec 1961. Contract AC02-84PW02789. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007652.

Portions are illegible in microfiche products; Declassified 8 Dec 1975.

Information pertinent to the neutron and gamma environment of the PWAR-16 drum dirve motors is supplied.

20323 **(NUREG/CR—3667) Guide for reviewing estimates of production-cost increases that result from nuclear power plant outages.** Peerenboom, J.P.; Buehring, W.A. (Argonne National Lab., IL (USA)). May 1983. Contract W-31-109-ENG-38. 65p. (ANL/EES-TM—241). NTIS, PC A04/MF A01 - GPO; GPO Dep. Order Number DE84009227.

Shutdowns of nuclear power plants typically result in significant increases in operating costs (production costs) for the affected utilities. This report presents a framework that will help users evaluate the reasonableness of estimated production-cost changes resulting from reactor shutdowns. The framework consists of three basic steps: (1) preliminary evaluation and classification of the outage, (2) evaluation of the input data and assumptions, and (3) evaluation of production-cost results. Several simplified procedures for estimating changes in production costs are presented.

20324 **(ORAU/IEA—83-13(M)) Economics of nuclear power: past record, present trends, and future prospects.** Phung, D.L. (Oak Ridge Associated Universities, Inc., TN (USA)). Dec 1983. Contract AC05-76OR00033. 40p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009509.

This paper examines the economic record of operating US reactors, factors affecting the economics of nuclear plants under construction, and opportunities for nuclear energy to escape from the predicament it faces today. The records of the 80 operating reactors indicate that they represent an indispensable asset, generating power at a lower cost than fossil-fueled alternatives. Yet many reactors under construction have suffered so much delay and cost escalation that they have become a financial burden to utilities and their customers. The technical, economic, and institutional reasons for this grotesque contrast between nuclear energy's potential and the problems it faces today are discussed. Changes necessary to improve the economics of nuclear power are also discussed. It is argued that the deployment of a meltproof reactor design, several of which are not under development, may solve the multifaceted problems of overregulation, long schedules, and financial risks.

20325 **Where do we go from here?: Successful reestablishment of nuclear power.** Patti, F.J.; Canter, H.R. (Burns & Roe, Inc., 185 Crossways Park Drive, Woodbury, NY 11797). *Transactions of the American Nuclear Society;* **45**: 587(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

20326 **The improving power market: Implications for nuclear power.** Siegel, J.R. (Atomic Industrial Forum, 7101 Wisconsin Avenue, Bethesda, MD 20814). *Transactions of the American Nuclear Society;* **45**: 522-523(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2907 Transport And Storage

REFER ALSO TO CITATION(S) 20312

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 20412, 20413, 20414, 20415, 20421

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 19783, 20357, 20417, 20422

20327 **(NP—4900337) Texas economic modeling capability with special reference to energy.** Holloway, M.L. (Texas Governor's Energy Advisory Council, Austin (USA). Forecasting and Policy Analysis Div.). 22 Apr 1977. 28p. NTIS, PC A03/MF A01. Order Number DE84900337.

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Important market determinants of the supply and demand for energy in Texas are modelled to estimate: national market clearing prices in the intermediate term under specified national policies; crude oil and natural gas supply response to price changes; major consumption response to price changes; ad hoc specifications of fuel distributions over time by major fuel using industries; the impacts of rising natural gas prices on Texas agriculture; and impacts of major policy changes on the electric utility industry. A general description of the Texas Energy-Economic Forecasting Model was provided to show how the various modeling efforts are interrelated. Selected results of three alternate energy programs were reported to demonstrate the analysis capability. A particular policy analysis example, natural gas boiler fuel restrictions, was also summarized.

20328 **(NP—4900855) National energy balance, 1983.** (Ministerio das Minas e Energia, Brasilia (Brazil)). 1983. 111p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84900855.

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Energy flows of different primary and secondary sources are shown from the production to the final consumption in every sector of the Brazilian economy. Data for 1970 and the years 1973 to 1982 are shown. Chapter headings are energy, balance, consumption of energy, foreign trade in energy, rates of growth, resources and energy reserves, and appendices.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 19665, 19683, 19730, 20026, 20027, 20311, 20345, 20755, 20756

20329 **(DOE/CS/20262—T1) Wisconsin state energy conservation plan: summary.** (Wisconsin State Energy Office, Madison (USA)). 1979. Contract FG01-79CS20262. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009362.

Wisconsin's State Energy Conservation Plan (SECP) has two primary objectives: (1) to provide the basic framework for a

coordinated, comprehensive state energy conservation program; and (2) to develop specific programs that meet the energy conservation needs of Wisconsin and satisfy mandatory federal energy conservation requirements. This framework is intended to provide a structure and sense of direction for future expansion and modification of the state's program. The Wisconsin State Energy Office has been given the responsibility for the development and administration of the SECP including monitoring implementation progress, measuring energy saved, and evaluating program effectiveness.

20330 **(DOE/RG/06390—T1) Comparison study of fuel utilization costs in the utility and industrial sectors. Final report.** (RAMCO, Inc., La Jolla, CA (USA)). 1979. Contract AC01-78RG06390. 206p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84009367.

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The Fuel Use Act (FUA) prohibits the use of petroleum and natural gas for certain power plants. FUA authorizes DOE to prohibit use of gas/oil by other power plants and installations. This program was conducted to investigate technical and cost considerations to support DOE's administration of FUA and includes: operation and maintenance; nonboilers in the petroleum refinery, petrochemical, foundries, grain drying, and brick/clay industries; causes and magnitude of derates in combustors due to fuel conversion; fluidized bed boiler; and assessment of alternate fuels and of progress in cutting gas/oil consumption.

20331 **(NP—4770185) Egypt - energy situation 1982/83.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1983. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770185.

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The energy situation of Egypt is reviewed on the basis of some relevant data. National and international energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade.

20332 **(NP—4770186) Zambia - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1983. 12p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770186.

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The energy situation of Zambia is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

20333 **(NP—4770189) Nepal - energy situation 1982/83.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1983. 9p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770189.

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Some basic data on energy supply in Nepal and some remarks on the use and ecological effects of the conventional wood fuel, the situation in the fields of petroleum and hydroelectric power is gone into.

20334 **(NP—4770192) Yemen Arab Republic - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1983. 10p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770192.

The energy situation of Yemen Arab Republic is described on the basis of some relevant data. Some remarks on national energy policy are followed by a description of the developments in power generation and in the various energy sources.

20335 **(PB—84-137272) Case study, candidate technologies to relieve the European energy system: Ireland. Final report.** Killen, L. (Commission of the European Communities, Luxembourg). 1984. 56p. (EUR—8035-EN). NTIS, PC E04/MF E04.

The case for introducing new energy technologies in a country highly dependent on imported energy is examined. Results are given for three runs of the EFOM-12C model aimed at reducing energy import costs. The following candidate technologies are included in the database for the model: coal liquefaction, conversion of power stations from oil to coal, wood burning power stations, and fluidised bed technologies; wood (biomass) for domestic heating; electric vehicles; wind, wave, and solar power technologies. The technologies are ranked according to their contribution to the Irish energy system up to the year 2020. Electric cars are consistently highly ranked as are the biomass options. Wave and solar energy do not feature in the solution.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 19665, 19667, 19667, 19678, 19679, 19683, 19689, 20306, 20309, 20311, 20316

20336 **(CONF-831112—6) Coal exports: a buyer's view of the market.** Bennett, R.J. (British Steel Corp., London). 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900852.

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

In conclusion, therefore, my buyer's view of the market can give coal producers little encouragement in the short term; only the hope of better things to come in, perhaps, three to five years time. The problem faced by the producers as I see it is one of survival during this interim period. We buyers would like to see a healthy and expanding coal industry supplying us, particularly in the United States where we have traditional trading connections and in many cases strong personal links. During this difficult period it is essential that producers also understand that the survival of their customers is also at stake and that our attitudes towards the market are determined mainly by the constant threat of extinction. The author goes into some detail about the major changes in the market from 1960 to date, the considerable increases in mining capacity in the various exporting countries, the effects of industrial malaise on the steel industry and on their coal requirements, on congestion in USA ports and its relief by construction of new and more efficient terminals, on coal mining costs, on coal transportation costs, and on future possibilities.

20337 **(NP—4770193) Investment in the community coalmining and iron and steel industries.** (European Coal and Steel Community (Luxembourg)). 1983. 101p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770193.

This report presents the results of a European Commission survey, undertaken essentially in the first half of 1982, of past and future investment by coal and steel enterprises in the European Coal and Steel Community (ECSC) and of the impact of such investment on production potential. Since then a number of enterprises have made new decisions, either closure, cancellations or postponements of investment projects, measures which were not planned when the replies to the enquiry were formulated. For a number of products the production potential in 1985 will be lower than the figure given by the enterprises in 1982, remaining none the less very much above the level of forecast demand given in the General Objectives. However, it is necessary to note that all steel industry restructuring programmes must, in accordance with the aids code, be subject to a definite decision at the Community level by 30 June 1983. It is certain that decisions concerning additional capacity reductions will be made during 1983, thus contributing to a better equilibrium in the period to 1985.

2960 Electric Power

REFER ALSO TO CITATION(S) 19981, 20422

20338 (DOE/ID/01809—T1) Engineering and computer analysis methods of determining utility system losses from published data. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Systems Technology Div.; Niagara Mohawk Power Corp., Syracuse, NY (USA)). Nov 1981. Contract FC07-78ID01809;AC01-78ET29192. 175p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84006089.

The purpose of this study was to verify the methodology developed in the previous study, Transmission and Distribution System Loss Study. The data, estimates, assumptions, and calculation methods of the original study were checked against the actual Niagara Mohawk system data. Losses calculated were compared to the system losses derived from actual system data. Revisions to the original methods were recommended to improve the accuracy of the results.

20339 (EPRI-EM—3227) Proceedings: workshop on planning for residential load management. Yau, T.S.; Miles, W. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA)). Oct 1983. 246p. (CONF-8303126—). Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

From Workshop on planning for residential load management; Atlanta, GA, USA (7 Mar 1983).

There was general agreement that load management can be beneficial to utility and customers alike if properly applied. Subsequent discussions then focused on the many different approaches to achieve these benefits. A common theme reoccurring through the Workshop was the need for reliable analytical tools (such as LOADSIM), which are accurate enough to evaluate real world utility questions, and flexible enough to analyze a portfolio of load management strategies.

20340 (FPC-R—87) All electric homes in the United States. (Federal Power Commission, Washington, DC (USA). Bureau of Power). Jan 1975. 31p. NTIS, PC A03/MF A01 - GPO $0.75. Order Number DE84900756.

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This report presents information on the average annual costs for representative amounts of electricity to consumers in homes utilizing electricity exclusively for all purposes. Average annual electric bills, average charges per kilowatt-hour and average kilowatt-hour consumption for these homes are shown on a nationwide basis and for each State and individual communities throughout the United States.

20341 (NP—24478) Cost/benefit analysis of demand-side planning alternatives. Final report. Barrager, S.M.; Buckley, O.E. (Decision Focus, Inc., Palo Alto, CA (USA)). Nov 1983. 143p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

This book offers a background in cost/benefit analysis as it relates to demand-site alternatives, such as conservation, direct control of appliances, dispersed generation, and time-of-use prices. This book serves principally as a guide for those individuals and groups who will actually do cost/benefit analysis or review the detailed technical work of others. Parts of the book are written for a second audience, individuals responsible for evaluating demand-side proposals but not necessarily involved in doing the analysis. This group includes utility managers or regulatory officials, and possibly, concerned lay persons. In addition to background information, this book provides a methodology for conducting a cost/benefit analysis of demand-site options. The six-step procedure includes consideration of uncertainty and determination of the value of experiments. The procedure is illustrated with four detailed examples - a direct load control program, a time-of-use price option, a conservation program, and an add-on heat pump program.

20342 (NP—4900386) Analysis of an alternate method for assessing fuel charges to electric utility customers. (Texas Governor's Energy Advisory Council, Austin (USA)). 4 May 1976. 11p. NTIS, PC A02/MF A01. Order Number DE84900386.

This report is an analysis of one of the ramifications of a proposed bill that reads in part as follows: In computing monthly charges to be passed on to customers resulting from charges in fuel costs, a gas or electric utility, shall compute the charges for residential customers based on the least expensive gas purchases used in that month up to the total amount used by all residential customers during that month and shall compute the charges for all other customers based on the cost of the remaining gas purchases used by the utility in that month. The data necessary for a complete analysis of the ramifications of this bill are not available. However, some of the most recent data available (for Lo Vaca Gathering Company, October, 1975) was used to examine some of the consequences of this bill on the electric customers of the City of Austin (Austin), City Public Service Board of San Antonio (CPS), and Central Power and Light Company (CPL) based in Corpus Christi and serving much of South Texas.

20343 (WAOENG—80-21) Washington State Electrical Contingency Plan. (Washington State Energy Office, Olympia (USA)). Dec 1980. 102p. Washington State Energy Office, 400 E. Union, Olympia, WA 98504.

The Washington State Electrical Contingency Plan has been designed to provide those parties who may be affected by an electrical supply shortage as well as public and private decision makers with a framework of meaningful options for dealing with various electrical shortfall scenarios. This plan has been developed as required by the statutory specifications of the Washington State Energy Office: RCW 43.21F.050(5); The energy office shall have the following duties...(5) To prepare contingency plans for implementation by state government in the case of a clear and foreseeable danger of energy shortages or actual energy emergencies. Such plans shall include procedures for determining when such shortages or emergencies exist, the state officers and agencies to participate in such determination, and actions to be taken by various agencies and officers of state government in order to reduce hardship and maintain the general welfare during such emergencies...

20344 Economic risks associated with rate case management. Manzi, J.E. (Kellogg Corporation, 5601 S. Broadway, Suite 400, Littleton, CO 80121). *Transactions of the American Nuclear Society;* **45**: 524(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 19676, 19677, 19679

20345 (NP—4900870) Florida energy data, 1970-1982. (Florida Governor's Energy Office, Tallahassee (USA)). Dec 1983. 96p. NTIS, PC A05/MF A01. Order Number DE84900870.

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Topics discussed are: energy consumption; comparisons by fuel type; renewable energy sources; crude oil and natural gas production; energy prices; and energy and the economy. Five appendices address: documentation of energy consumption by sector and fuel; documentation of energy prices by sector and fuel; glossary; energy conversion factors; and US petroleum net imports.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 19870, 19900, 19917, 19927, 20355, 20407

20346 **(DOE/SF/11686—T1) Administrative support of Regional Appropriate Technology Small Grants Program. Final report.** (TEM Associates, Inc., Berkeley, CA (USA)). Dec 1983. Contract AC03-82SF11686. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007422.

The support of the DOE San Francisco Operations Office in the Regional Appropriate Technology Small Grants Program was in two parts: administrative assistance to the DOE regional program manager and technical monitoring of the active grants in Arizona and New Mexico. A final summary of the status of each of the three remaining projects is presented. The three projects are: Sagebrush Pelletizer for Use as a Fuel Source, Demonstration Program Using Wind-Power to Generate Electricity, and Passive Solar Chimney Demonstration. (MHR)

20347 **Prospects for chemicals and fuels production by fermentation.** Cooney, C.L. (Massachusetts Inst. of Technology, Cambridge). pp 307-316 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

Problems of developing a Biochemical Process Industry are discussed. Among difficulties holding back the development of this industry are: (1) there is unproven and volatile pricing for biomass; (2) Generally, biochemical processes have a low volumetric productivity. In the chemical industry one wants to see one to two moles of product per liter per hour. Often biochemical processes are less than 10% of this value; (3) unproven technology, particularly in regard to scale-up; (4) the capital intensivity of biological processes compared to many chemical routes; (5) a high water requirement in biological processing, and (6) the fact that in biochemical processes one often has co-product processes.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

20348 **(DOE/ET/10815—74) Cold flow modeling of pulverized coal combustors for magnetohydrodynamic channel applications.** Schulz, R.J.; Giel, T.V.; Ghosh, A.; Morris, R.D. (Tennessee Univ., Tullahoma (USA). Space Inst.). Mar 1984. Contract AC02-79ET10815. 62p. (UTSI—82-18). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008052.

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This report describes an experimental program and techniques for studying the internal aerodynamics of pulverized coal combustors of the type used in magnetohydrodynamic test trains at The University of Tennessee Space Institute. The combustors are modeled with small scale, cold flow models that permit both flow visualization and velocity field surveys to be performed. Water was selected as the working fluid so that the model flow fields had the same Reynolds number as the actual reactive combustors, and also to facilitate flow visualization. The systems used for flow visualization and velocity field surveying are described in detail. The velocity field survey equipment is based on a vector-velocity, laser doppler velocimeter coupled to a controllable field scanning device and a microprocessor for on-line data reduction. Results are presented that were obtained from a laser velocimeter study of recirculating flows in a combustor model. The results show that, even for exceedingly simple geometrical arrangements of oxidant injector configurations, complex three dimensional highly turbulent flow fields exist in the combustor. A brief discussion of the impact of the results on fuel injector positioning is presented.

20349 **(DOE/ET/10815—88) One-dimensional code to predict the thermal behavior of the UTSI MHD radiant furnace.** Galanga, F.L. (Tennessee Univ., Tullahoma (USA). Space Inst.). Mar 1984. Contract AC02-79ET10815. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008283.

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An analytical model of the thermal behavior of the radiant furnace components installed in the CFFF has been developed. Efforts have been primarily directed towards obtaining a representative global evaluation of the heat recovery of the major downstream components. An overall review of the heat transfer code developed specifically for the DOE CFFF downstream components is presented. The basic methods by which the gas state, transport properties, and the thermal radiative and convective properties are calculated are delineated. Since the thermal behavior of the furnace is radiation dominated, a greater emphasis was placed on this mode of heat transfer. The heat transfer model employs a single zone approximation to the physical problem. The results of the code show good agreement with the experimental data. A more rigorous approach to the problem requires the use of a multi-zone analysis which is presently under consideration. 21 references. (WHK)

20350 **(DOE/ET/15611—15) High magnetic field MHD generator program. Final report, October 1, 1979-February 29, 1984.** Eustis, R.H.; Kruger, C.H.; Mitchner, M.; Self, S.A.; Koester, J.K.; Nakamura, T. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Feb 1984. Contract AC22-80ET15611. 136p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84007690.

Experimental and theoretical research has been conducted to investigate phenomena that are expected to be important in the development of MHD power generation. In several areas, advanced diagnostics were developed to permit experimental measurements which could be compared with theory. The areas under investigation are: effects of nonuniformities on generator performance, stability phenomena, boundary layer phenomena, Hall field breakdown, electrode configuration and current concentrations, disk generator studies, and linear generator experiments at high fields. This report describes the motivation and objectives of the work in the several areas and collects in one place many of the important results. Detailed accounts of the methods and findings in each area are given in specific publications that are listed.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 20503

20351 **(DOE/ER/10492—T1) Mechanisms of electrocatalytic kinetics of oxidation of hydrocarbons on solid-oxide electrolyte-electrode surfaces. Final report.** Mason, D.M. (Stanford Univ., CA (USA)). 27 Dec 1983. Contract AT03-79ER10492. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008048.

This report presents highlights of the results obtained to date on an ongoing investigation of the electrocatalytic mechanisms involved in the anodic oxidation of selected hydrocarbons derivable from coal gas, and the cathodic reduction of O_2 in a fuel cell employing Sc_2O_3-or Y_2O_3-stabilized ZrO_2. The particular focus of the work has been to perform definitive experiments to show that the solid electrolyte plays an important role in electrocatalysis compared to the porous metallic electrode. It has been observed that great enhancement in reaction-rates and current drawn at a given overpotential occurs when the electrolyte is blackened by electrolysis, forming a stable suboxide of zirconia, ZrO/sub 2-x/. Simple potentiometric measurements with pure H_2, CO, CH_4, CH_3OH and C_2H_5OH, as the fuel and air oxidant have been made on both the ZrO_2-Sc_2O_3 system in both the unblackened and blackened state. The general kinetic information resulting from this study is being used for optimal modeling and design of practical tubular shaped solid-electrolyte fuel cells employing air and hydrocarbons. A laboratory scale tubular electrochemical reactor has been constructed to provide experimental data of value in modeling.

20352 **(DOE/ET/13114—T8) Electrode optimization for phosphoric acid fuel cells. Final report.** Christner, L.; George, M. (Energy Research Corp., Danbury, CT (USA)). May 1981. Contract AC01-78ET13114. 55p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009427.

The objective of this program was to develop improved electrode structures for use in phosphoric acid fuel cells. The specific objectives included maximizing the peak performance levels of supported catalyst type electrodes while, simultaneously, maintaining acceptable electrode endurance capabilities. Another objective was to improve the reproducibility of full cells containing the experimental electrodes by eliminating side effects associated with the cell matrix and hardware. All aspects of the electrode structure were considered during this investigation. This study involves the preparation and characterization of the electro-catalyst, catalyst support material, catalyst layer and the electrode substrate. Details of the key results and accomplishments are presented. (WHK)

20353 **(DOE/OR/21400—T2) Cathode materials development for carbonate fuel cells. Final report.** Baumgartner, C.E. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center). 1984. Contract AC05-84OR21400. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010033.

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The electronic conductivity of cation doped ZnO and $LiFeO_2$ samples was determined between 773 to 1123°K under a 30% CO_2/air atmosphere using a 4-probe AC impedance technique. The highest conductivities recorded at 923°K, the operating temperature of a molten carbonate fuel cell, were 5.3×10^{-1}, 3.5×10^{-1}, and 1.5×10^{-1} $(ohm\text{-}cm)^{-1}$ for $Zn_{0.942}Zr_{0.058}O$, $LiFe_{0.921}Cr_{0.079}O_2$, and $LiFe_{0.930}Cu_{0.070}O_2$ respectively. Following 1000 hours at 923°K in a Li/K carbonate melt (62/38 mole ratio) under a CO_2/O_2 atmosphere, the above Cr-doped $LiFeO_2$ sample decomposed to $LiFeO_2$ and alkali-carbonate-soluble Cr salts. The other samples remained intact during this test. The equilibrium solubility of NiO, ZnO, $LiFeO_2$, and $LaNiO_3$ in Li/K carbonate was quantitatively measured between 823 to 1223°K under various CO_2/O_2 containing gas atmospheres (constant CO_2/O_2 ratio of 2/1). The solubility of all materials, except $LaNiO_3$, was found to increase with increasing temperature for each gas system investigated, however, quantitative measurements at the lower temperatures were hindered by high elemental impurity levels in the nascent carbonate. The equilibrium solubilities of NiO, ZnO, and $LiFeO_2$ at constant temperature varied linearly as $CO_2 + O_2$ was replaced by N_2 with both ZnO and NiO showing a decreasing solubility with increasing N_2 while the $LiFeO_2$ solubility change was in the other direction. The $LaNiO_3$ solubility remained below the quantitative detection limit until the melt's temperature exceeded 1123°K at which time material decomposition occurred.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 20329

20354 **(DOE/CE/15151—T1) Appropriate Technology Small Grants Program evaluation. Executive summary. Volume I.** (Cardinal Management Associates, Inc., Los Angeles, CA (USA)). Mar 1984. Contract AC01-82CE15151. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84010080.

The study was to provide the Department with data to be used in preparing a report to Congress and the President containing the following: (1) an assessment of how well the Program achieved its objectives; an assessment of how well the Program stimulated the overall use of appropriate technologies in various markets; (3) an assessment of the overall energy savings impact of the Appropriate Technology Small Grants Program, as well as other direct and indirect program impacts including new technologies, products, devices, businesses, jobs, etc., developed as a result of the Program; (4) case studies of 20 successful grants and their actual or potential individual energy savings and other direct and indirect impacts; and (5) an identification and analysis of the factors that contributed to successful and unsuccessful grants, with recommendations for improvement of other similar governmental and non-governmental programs. To provide the proper context, the specific findings of the study are highlighted in this Executive Summary, following a brief overview of the Appropriate Technology Small Grants Program and of the evaluation methodology.

20355 **(DOE/CE/15151—T2) Appropriate Technology Small Grants Program evaluation: case studies. Volume III.** (Cardinal Management Associates, Inc., Washington, DC (USA)). Mar 1984. Contract AC01-82CE15151. 155p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84010082.

A non-random sample of the Appropriate Technology Program grantees was selected to ensure that the basic goals of the evaluation study were met. Case studies of selected outstanding projects could provide with respect to the Program dynamics associated with success. It was believed that the non-random case study approach would assist us in assessing which approaches have the potential to impact a reduction in our nation's use of non-renewal energy. From this group of projects, 20 projects were selected to highlight in a case study format which illustrates the various types of projects approaches the Program supported.

20356 **(DOE/CE/15151—T3) Appropriate Technology Small Grants Program evaluation. Volume II.** (Cardinal Management Associates, Inc., Washington, DC (USA)). Mar 1984. Contract AC01-82CE15151. 149p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84010081.

The scope of this study included the selection of a random sample of 90 Appropriate Technology grant projects for review, which would ensure an overall, objective analysis of the Program. In addition, the statement of work requested that a non-random selection of 20 grantees be developed. The non-random projects would be illustrated through case studies and would include examples of some of the Program's most successful projects. The study was to provide the Department with data to be used in preparing a report to Congress and the President containing the following: (1) an assessment of how well the Program achieved its objectives; (2) an assessment of how well the Program stimulated the overall use of appropriate technologies in various markets; (3) an overall energy savings impact of the Appropriate Technology Program, as well as other direct and indirect Program impacts including new technologies, products, devices, businesses, jobs, etc., developed as a result of the Program; (4) case studies of the 20 most successful grants and their actual or potential individual energy savings and other direct and indirect impacts; and (5) an identification and analyses of the factors that contributed to successful and unsuccessful grants, with recommendations for improvement of other similar governmental and non-governmental programs.

3201 Buildings

REFER ALSO TO CITATION(S) 19940, 19942, 20408, 20409, 20410

20357 **(AD-A—136403/3) Simplified confidence intervals for an awkward nonlinear model. Technical summary report.** Goldberg, M.L.; Bloomfield, P.; Fels, M.F. (Wisconsin Univ., Madison (USA). Mathematics Research Center). Nov 1983. 34p. (MRC-TSR—2601). NTIS, PC A03/MF A01.

A simple method is developed for approximating confidence intervals for a linear change-point model representing residential energy consumption. The method can be applied to any nonlinear model which is conditionally linear in all but one parameter. The approximation is shown to be more accurate than the Gaussian approximation, and easier to compute than confidence intervals defined by likelihood (sum-of-squares) regions. Computations are described in some detail for the motivating model.

20358 **(BMFT-FB-T—83-255) Damage to external walls with cavity insulation.** Schweikert, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1983. 57p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750725.

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The performance of double-shell brick wall with cavity insulation under ordinary practical conditions has scarcely been examined, and there is a lack of specialist literature dealing with the significant aspects of subject. To a large extent, the task of providing advice on design and construction has been left to the manufacturers of insulating materials, even though for some types of construction licenses have been granted by the building inspection authorities. Because of the present high energy costs, there is a growing tendency to construct external walls with cavity insulation; it is therefore necessary to determine the conditions that are likely to affect this type of construction before general rules and recommendations can be formulated in order to achieve damagefree constructions over prolonged periods and ensure their effective functioning. The relevant information can best be obtained from a statistical survey of problem points, crucial areas of damage, causes and conditions that may lead to damage, and typical shortcomings in planning and execution. The results of the survey are mainly related to the following problem areas: incidence and main features of damage - causes of damage and defects (external wall cross section, points of detail, design and construction, building materials etc.) - weaknesses of certain of construction methods according to current technological standards - typical shortcomings in planning and execution. If duly taken into account by regulations, recommendations, licenses granted by the building authorities, and instructions for execution, the results of the survey are apt to reduce the risk of damage and contribute to the economy of this type of construction.

20359 **(CONF-840266—1) Overview of DOE-sponsored heat pump research.** Fairchild, P.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007561.

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

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Technical management of DOE research activities related to residential and commercial heat pump technology is assigned to Oak Ridge National Laboratory. The following are discussed: program size and research emphasis, design analysis and optimization, dynamic loss phenomena, heat pump capacity modulation, ground-coupled heat pump technology, nonazeotropic refrigerant mixtures, and future research areas. (MHR)

20360 **(CONF-840506—1) Passive generation and storage of winter ice for summer cooling applications.** McGarity, A.E.; Gorski, A.I. (Swarthmore Coll., PA (USA). Dept. of Engineering; Argonne National Lab., IL (USA)). May 1984. Contract W-31-109-ENG-38. 7p. S; 3; GPO Dep. Order Number DE84007549.

From 2. international energy exposition and conference - ENERGEX '84; Regina, Canada (14 May 1984).

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The results of analytical and experimental work on a cooling system which uses phase-change seasonal energy storage are presented. The system uses a heat pipe to chill passively the storage medium during the winter season. During the summer, the storage medium is used as an energy sink for the cooling system of a building. The storage medium is a material that freezes at a temperature in the range 0 to 15°C. Experiments have been performed with a prototype system using water as the storage medium at Argonne National Laboratory and large quantities of ice have been grown in an insulated tank with no use of auxiliary energy. Alternative storage materials are clathrate hydrates which freeze at temperatures above 0°C. The use of such materials can extend the freezing season and enable the operation of the system in climates with somewhat mild winters. Here, estimates of system performance and system costs are combined to examine the economic feasibility of water-ice and clathrate hydrate systems in different climates. It is found that water-ice systems may be economically feasible in certain climates. It is also found that using a clathrate hydrate can reduce the size and cost of the heat pipe, but this cost reduction is offset by the high cost of most of the currently known clathrate forming chemicals.

20361 **(DOE/CE/23861—T1) Briefing paper on the warm room project.** Kensill, F. (Institute for Human Development, Philadelphia, PA (USA)). 31 Oct 1983. Contract AC01-83CE23861. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009896.

The possibility of energy savings for the poor and elderly through the warm room concept is explored. This concept allows an occupant to localize heat to only one room at a time and effectively cut fuel consumption in half. (MHR)

20362 **(DOE/CE/23861—T2) Differential space heating in single-family dwellings.** (Institution for Human Development, Philadelphia, PA (USA)). 1982. Contract AC01-83CE23861. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009346.

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Different options are compared for keeping one part of a living space at a warmer temperature than the remainder of the house. Equipment costs are noted, and savings are analyzed using a two-chamber model of heat dispersion. Considerations of health and safety are also discussed.

20363 **(DOE/CE/23861—T3) Differential space heating in single-family dwellings.** (Institute for Human Development, Philadelphia, PA (USA)). 1982. Contract AC01-83CE23861. 40p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009895.

Differential space heating is defined as the practice of maintaining one part of a house at a higher temperature than the rest. Three classes of approaches to the problem are examined: First, use of local space heat sources either to supplement or supplant central heat; second, zoning of the central heating plant to accomplish the same end; and third, installation of a super-insulated room within a room. A qualitative discussion of the different systems will be presented, followed by a technical analysis and then a summary of initial and operational costs, projected for the climate conditions of four American cities.

20364 **(DOE/CE/64835—1) School finance and energy through the year 2000.** (Hansen (Shirley J.) Associates, Inc., Lake Jackson, TX (USA)). Mar 1984. Contract AP01-83CE64835. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009358.

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The current and projected fiscal condition of America's public schools and the impact energy could have on school finances through 2000 are addressed. The following are discussed: the economy, the public school, energy projections, energy and its impact on the schools, and financing energy conservation. (MHR)

20365 **(DOE/CS/20271—1) Project description: design and operational energy studies in a new high-rise office building. Volume 1.** (Tishman Research Corp., New York (USA)). Dec 1983. Contract AC02-79CS20271. 126p. NTIS, PC A07; 3; GPO Dep. Order Number DE84009371.

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A large, privately-owned, office building was thoroughly equipped with sensors to measure energy consumption by specific systems over an extended period of time. The building is a 26-story, glass, office tower sited on an open plaza and connected by a pedestrian bridge to a second, smaller building (primarily servicing PSE and G's customers) which is located on the plaza. A large computer installation controls the utility's entire electric grid and is located in the lower levels of the building below the plaza. The building is occupied by approximately 3400 people including executive, professional, and clerical staff. The building was designed to be energy efficient, with an annual energy consumption of about 60,000 Btu's per square foot, in accordance with the nationally recognized ASHRAE 90-75 standard. Extensive energy data was collected from August 1981 through July 1983. A weather station was installed on the roof to record data on the microclimate. Data from these sensors was continuously recorded by the building automation computer over a period of two years to provide a profile through

several seasonal cycles. Additional weather data was obtained from the PSE and G, Maplewood station located nearby. A summary of this data is included.

20366 **(DOE/CS/20327—T1) Energy conservation in new buildings. A critique and alternative approach to the Department of Energy's Building Energy Performance Standards.** (Consumer Energy Council of America, Washington, DC). Apr 1980. Contract FG01-79CS20327. 438p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE84009426.

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A series of major national energy policy studies in the last year or two are reviewed. From these studies, estimates of the potential contribution that each of 25 energy options can make to the nation's energy resources were extracted. These projections are compared to the contributions to energy conservation that BEPS would achieve. It was found that the nominal standards fall far short of even the low projections in the national studies. Criticisms of DOE's efforts in the area of energy conservation are presented in detail. (MHR)

20367 **(DOE/CS/20529—T1) Phase two report for the development of energy performance standards for new buildings. Task report: mobile homes.** (AIA Research Corp., Washington, DC (USA)). 1979. Contract AC01-77CS20529. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009476.

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Research to develop technical information on the designed energy performance of mobile homes is described. In Phase 2, the objective was to estimate how much less energy mobile homes could be designed to use. Four prototype models were developed derived, with some adjustments, from the NAHB/RF Phase 1 survey. The prototypes were then used to develop four designs for mobile homes with the purpose of achieving the maximum technically feasible level of energy conservation. Finally, the maximum technically feasible designs and the prototype designs were compared with the prototypes as modified to the proposed increases in thermal performance in the April 1978 version of HUD's Minimum Property Standards (HUD/MPS). In addition, an exhaustive literature search was undertaken to compare the only standards governing mobile home construction, the Federal Mobile Home Construction and Safety Standards, with other codes and standards, including, but not limited to, those written by the model code agencies, the states, the Federal Home Administration (FHA), the Farm Home Administration (FmHA), and industry consensus standards such as those promulgated by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), and the National Conference of States on Building Codes and Standards (NCSBCS).

20368 **(DOE/CS/20529—T2) Phase two report for the development of energy performance standards for new buildings. Task report: single-family dwellings.** (AIA Research Corp., Washington, DC (USA); NAHB Research Foundation, Inc., Rockville, MD (USA)). Jan 1979. Contract AC01-77CS20529. 203p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84009521.

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This report documents the single-family residential portion of a research project that developed information upon which nationally uniform and locally responsive energy performance standards for new building design could be based. The Phase 1 data base was modified to produce estimates of the dwellings as if they had been designed to conform with two current energy standards for residential design. One was the April 1978 version of HUD Minimum Property Standards, a component-based performance standard; the other was NAHB's Thermal Performance Guidelines, a cost/benefit approach for calculating levels of thermal protection. The research undertaken is described. To provide information on the maximum technically achievable levels of energy conservation in single-family dwellings, 20 design teams with demonstrated experience in energy-conserving residential design were selected. The design teams were asked to develop designs that approached the leading edge of energy-conserving design. The dwellings were developed on the basis of prototypical building programs representing the median characteristics of the original data base, and thus reflecting current market conditions. The energy-conserving designs were used to produce estimates of designed energy performance. The maximum technically feasible design program is described in detail. Technical issues that arose from both portions of the residential research are described.

20369 **(DOE/CS/20529—T3) Phase two report for the development of energy performance standards for new buildings. Appendix D. Energy conscious designs.** (AIA Research Corp., Washington, DC (USA); Arnold (T.R.) and Associates, Inc., Elkhart, IN (USA)). Jan 1979. Contract AC01-77CS20529. 612p. NTIS, PC A99; 3; GPO Dep. Order Number DE84009960.

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Appendix D includes selected drawings from each of the 168 commercial and multifamily redesigns, the 20 energy-conserving single-family dwelling designs, and the 4 energy-conserving mobile home prototypes. Individual drawings from each project were chosen as the most illustrative of the energy conscious design strategies used. They are organized to reflect the conceptual framework of location, form and metabolism emphasized throughout the project. The framework was intended to place equal emphasis on the full range of energy conscious design possibilities. Location referred to site and orientation; form referred to building shape, structure and envelope treatment; and metabolism referred to such energy-conversion portions of building design as mechanical equipment and electrical systems. Project drawings are accompanied by descriptions of the key energy-related design concepts abstracted from summary reviews of each project. The mobile home prototypes are described by their design specifications. The architects, engineers and/or homebuilders for each project are identified, and the projects are grouped by building type and geographic regions (east, midwest and west).

20370 **(DOE/CS/20529—T4) Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings.** (AIA Research Corp., Washington, DC (USA)). 1979. Contract AC01-77CS20529. 384p. NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE84009453.

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This report documents the commercial and multi-family residential portion of a research project that developed information upon which nationally uniform and locally responsive energy performance standards for new building design could be based. The Phase 2 commercial and multi-family residential research was designed to refine and expand the work on Phase 1, building upon that data base to provide HUD and DOE with reliable technical information as a basis for policy decisions and technical judgments about the nature, scope, and implementation of the proposed energy performance standards. The following are included in development of data: sample design and selection, original designs modification to standards, and redesigns. The energy analysis method of data processing is presented. A comparative analysis of results using different estimating methods is described. (MHR)

20371 **(DOE/CS/30241—1) Project journal: teaching passive design in architecture.** Fraker, H.; Prowler, D. (Pennsylvania Univ., Philadelphia (USA)). Nov 1981. Contract AC02-79CS30241. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009341.

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The Journal has been organized into two sections. The first section is an essay which articulates underlying theoretical issues and questions about design methods and their potential impact on design education. These issues and ideas form the philosophical basis on which the overall project was organized and managed. As a result of protracted dialogue with educators from the participating schools, these views, ideas and constructs have been altered in fundamental ways. The second section of the Journal can be summarized as A Resource Guide. It is divided into four chapters. The first chapter is an abbreviated Project History which highlights significant events and major goals. The second chapter (Summaries and commentary) presents excerpts from the participating schools and includes critical commentary by the principal investigators.

The third chapter is a Pedagogical Guide which organizes the material from the schools into appropriate categories of learning styles and teaching settings. It allows a design critic to see at a glance how each of the packages is intended to be used in a variety of traditional teaching settings in schools of architecture. The last chapter is a Technical Index. This is an attempt to structure and present minimum technical models which should be internalized for the designer to become thermally literate. Thic chapter also places the technical contribution of each school in a larger framework.

20372 **(DOE/CS/60204—2) Michigan community based thermogram information program: comparison of participants and nonparticipants.** Jeppesen, J.C. (Michigan Dept. of Commerce, Lansing (USA)). 1983. Contract FG45-77CS60204. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009931.

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This paper describes and compares the family demographics, housing characteristics, energy related perceptions and conservation profiles of MIchigan householders who either participated or did not participate in one of several community wide thermogram (heat loss) information programs. These thermogram information programs involved the offer to view, at no cost, a graphic heat loss picture of the front of one's residential structure and to also receive associated information on available energy conservation options. Unlike many general energy conservation awareness programs this program, called the Community Energy Management (CEM) program, offered specific housing structure information coupled with needs assessment dialog and targeted provision of how to information on residential energy efficient remedies. in addition to documentation of high rates of participation realized by this program findings from the evaluation compare and contrast the characteristics of participants and nonparticipants. Noteworthy among these findings is the fact that participants tend to do more conservation actions following receipt of thermogram information but that the types of actions this represents are frequently indirectly related to actual heat loss information.

20373 **(DOE/CS/60490—T1) Management institute on the conservation of energy for New England institutions of higher education. Final report.** (New England Board of Higher Education, Wellesley, MA (USA)). 1980. Contract FG01-79CS60490. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007862.

The following are discussed: planning, organizing, and implementing the grant; the management institute; dissemination of information and planned follow up actions, and financial report. (MHR)

20374 **(DOE/IR/01691—T1) Non-formal education and energy conservation policy: a case study of California.** Wilms, W.W.; McCarthy, M.; Moore, R. (California Univ., Los Angeles (USA)). 3 Nov 1980. Contract FG03-77IR01691. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007902.

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The impact on manpower Regulations for Establishing Energy Conservation Standards for New Nonresidential Buildings and the solar tax credits for California is explored. The impact is found to be qualitative rather than quantitative. The study methodology and findings are presented. (MHR)

20375 **(DOE/IR/01691—T2) Manpower requirements for energy conservation: a case study of California.** Wilms, W.W.; McCarthy, M.A.; Moore, R.W. (California Univ., Los Angeles (USA). Graduate School of Education). 15 Jul 1982. Contract FG03-77IR01691. 152p. NTIS, PC A08; 3; GPO Dep. Order Number DE84007935.

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This case study of California's new energy conservation policies concludes the impact of such legislation is qualitative, not quantitative. Substantial numbers of new jobs are not created by these policies, but some new knowledge is required by the existing workforce to adequately comply. The study suggests that the conventional manpower requirements approach to planning that attempts to numerically match supply and demand is not a productive way to plan for qualitative changes in the workforce. Instead, the study details how regulations act to create an information and training system that operates on natural incentives. In California, these new energy policies created an immediate demand for relevant information by designers, builders and building officials. Further, the investigation describes the existence of a non-formal training system and how it emerges in the short-run to meet immediate knowledge demands. The study shows how building inspection that insures uniform compliance can act to close the system, thereby intensifying designers and builders demands for new knowledge which are met by non-formal training organizations - trade and professional associations and manufacturers. Though the study shows how this system driven by regulations on one end and bounded by inspection and enforcement on the other, operates without central guidance, it identifies key barriers that impede its effectiveness. The study recommends specific steps the US Department of Energy and state energy planners can take to improve the system's effectiveness by learning from the California experience.

20376 **(DOE/MI/10001—T1) Housing fuel consumption and journey to work patterns of minorities: their implications for federal energy policies. Final report.** (National Urban League, Inc., Washington, DC (USA). Research Dept.). 14 Jun 1983. Contract FG01-82MI10001. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009458.

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This report attempts to examine housing fuel and transportation costs for black heads of households based on responses to the National Urban League's (NUL) 1979 national survey of blacks entitled Black Pulse. Using the NUL Black Pulse survey as the primary data source, the cost and level of energy consumption is profiled for three strata of black households. The general methodology and scope of the survey is presented followed by separate descriptions of housing conditions and fuel costs as well as estimates of the cost and consumption of fuel used for transportation to work. (MHR)

20377 **(DOE/R5/10318—T1) Residential heating with wood residues on the Red Lake Indian Reservation. Final report.** (Red Lake Band of Chippewa Indians, Red Lake, MN (USA)). 8 Mar 1984. Contract FG02-81R510318. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009100.

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Information related to wood residue fuel consumption and fossil fuel displaced, operating costs, maintenance, environmental, safety, transportation and delivery requirements were recorded throughout the operational phase of the project. The Demonstration Project also involved an assessment of the various wood fuel densifying systems which are commercially available. Capital and operating costs, reliability of performance and appropriateness to the wood resource and fuel needs of the Red Lake Reservation area were addressed as part of selecting the most appropriate type of densifying system for possible future purchase by the Tribe. Systems which were assessed included pelletizers, log machines, cubers and briquet machines. The ultimate goal of the Demonstration Project was to select the most advantageous methods of eventually converting the entire Red Lake Indian Reservation to the use of wood residues as a fuel source. The project methodology, major results and conclusions of the project, and a description and analysis of the wood-fired heating system which was installed are presented.

20378 **(DOE/R7/01001—T1) Retro-fitting a house to take advantage of cool basement walls to reduce air conditioning cost. Final report.** Williams, F.P. (Williams (Frank P.), Cedar Falls, IA (USA)). 29 Sep 1981. Contract FG47-79R701001. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007765.

Directions are given for a simple ventilation system to bring cool basement air to the living areas. Some results are given for electrical consumption for air conditioning before and after the retrofitting. (MHR)

20379 **(DOE/R7/01014—T1) Integrated adaptation of energy conservation technology to Kansas dwelling. Final technical report.** Duffy, R.; Duffy, C. (Duffy (Ross), Topeka, KS (USA); Duffy (Carolyn), Topeka, KS (USA)). Jun 1981. Contract FG47-79R701014. 27p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007753.

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The dwelling constructed measures approximately 1600 sq. feet, is more-or-less on one level with the back portion raised 2 feet higher than the front portion, has a conventional roof, faces directly south, is earth-integrated - ground is bermed up to the roof level on the north and west, is faced on the front (of both levels) by much glass to allow for passive solar collection, incorporates a trombe wall on the front for additional solar collection, walls and floors are concrete to serve as storage mass. A storage room in the back portion is ceilinged with concrete to function as a storm shelter and also to add storage mass and an additional greenhouse area. A major greenhouse is to be added to the front of the structure as soon as possible for the purpose of food production and also passive solar heat collection. The entire structure is heavily insulated. A two-story garage is nearby, but separate (to prevent heat loss from the house); an enclosed entranceway joins the two and also serves as an airlock during colder weather.

20380 **(DOE/R7/01038—T1) Double wall pole construction.** (Allen (Edward P.), Ralston, NE (USA)). Mar 1982. Contract FG47-79R701038. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007738.

The construction of a house is described which uses a wall both inside and outside of the pole structure creating a wall cavity of 8 to 10 inches which is filled with a loose type insulation made from renewable wood cellulose. Construction reports and heat loss performance are included. (MHR)

20381 **(DOE/R7/01039—T1) Earth assisted annual energy cycle home. Final progress report.** Chesen, E.S. (Energy Innoventions, Lincoln, NE (USA)). 27 Jan 1981. Contract FG47-79R701039. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007739.

This project makes use of sub-basement earth as a massive heat sink and extracts natural ground heat from all tap water coming into the dwelling actually using or wasting water. Heat storage gain from the earth surrounding the four 1800 gallon concrete storage tanks was documented.

20382 **(DOE/R7/01135—T1) Refrigeration system using outside air. Final report.** Niemann, E.E.; Niemann, K.E. (Niemann (Eugene E.), Appleton City, MO (USA); Niemann (Kelly E.), Appleton City, MO (USA)). 29 Mar 1982. Contract FG47-80R701135. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007861.

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A system is described to use outside ambient air in conjunction with conventional refrigeration systems in a grocery store, by the use of an insulated duct system connecting all refrigeration cases maintaining a 38° temperature, or less. When outside temperature drops below a predetermined temperature all compressors in use stop, except for one, which is connected to a coil in the return air duct system. When temperature drops below a second predetermined point lower than the first, the last compressor stops. An outside damper is opened and cold air is brought into the duct system and distributed into the refrigerated cases after being cleaned. By turning off compressors when not needed it is hoped to save a substantial amount of electricity when situs of application permits low enough ambient temperatures.

20383 **(DOE/R7/01145—T1) Energy conservation in multi-family dwellings. Final report.** Hansen, T. (Hansen (Tim), Wichita, KS (USA)). 31 Oct 1981. Contract FG47-80R701145. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007854.

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This study examined two aspects of energy conservation in multi-family dwellings: Part A measured the correlation between building orientation and electricity consumption; Part B tested the effectiveness of simple conservation activities on electricity consumption in one specific apartment. A strong correlation was found between orientation and consumption for winter months. Units facing southwest used an average of 22% less electricity than units facing north. Since lighting, appliance use and hot water use are not directly related to orientation (as is space heating) the potential savings of energy used for heating is expected to be significant if principles of building orientation are properly applied. Due to a variation in individual tenants' use of air conditioning, the correlation factor for summer months was not significant. Combining results from both January and July confirm that west and southwest are probably the most advantageous (1.3% and 6.5% fewer average kilowatt-hours, respectively) in terms of energy conservation. This condition differs from the earlier hypothesis that south-to southeast-oriented apartments would use the least amount of energy. Part B results make a strong case for residential conservation measures. When compared to control months (January and July), electricity consumption in the experimental months (February and August) was reduced 15% in the winter and 31% in the summer. Judging from the high standard deviation between units having similar orientations, individual lifestyle habits are a major factor in overall energy consumption.

20384 **(DOE/R7/01204—T1) Demonstration house and resource center for appropriate technology. Final report, October 1, 1981-June 30, 1982.** (Energy Research and Information Foundation, Des Moines, IA (USA). Thoreau Center). 18 Apr 1983. Contract FG47-81R701204. 32p. NTIS, PC A03; 3; GPO Dep. Order Number DE84010098.

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The Thoreau Center was developed as an effective demonstration for appropriate technology in Des Moines, Iowa. Efforts included: (1) physical improvements for which funding was granted: insulation of walls of the brick house from inside, and painting of walls with vapor-barrier paint; construction of a batch-type or breadbox solar hot water pre-heating system; construction of a variety of window insulation treatments for all windows; evaluation of the Center's energy use over a three year (4th year included as well) period; insulation of basement (office) space using several alternative methods; investigation of various projects, such as the originally proposed greywater system and ceiling fans; and continued emphasis on winterization and low-cost conservation methods such as caulking, weatherstripping, waterheater insulation, lowered thermostat, etc. Services of the Resource Center Library which were supported through grant funds are summarized.

20385 **(EPRI-EA—3409) Household appliance choice: revision of REEPS behavioral models. Final report.** Goett, A.A. (Cambridge Systematics, Inc., Berkeley, CA (USA)). Feb 1984. 75p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report describes the analysis of household decisions to install space heating, central cooling, and water heating in new housing as well as decisions to own freezers and second refrigerators. This analysis was conducted as part of the enhancements to the Residential End-Use Energy Planning System (REEPS) under EPRI project RP1918-1. The empirical models used in this analysis were the multinomial logit and its generalization the nested logit. The choice model parameters were estimated statistically on national and regional survey data. The results show that capital and operating costs are significant determinants of appliance market penetrations, and the relative magnitudes of the cost coefficients imply discount rates ranging from 3.4 to twenty-one percent. Several tests were conducted to examine the temporal and geographical stability of the key parameters. The estimated parameters have been incorporated into the REEPS computer code. The revised version of REEPS is now available on a limited release basis to EPRI member utilities for testing on their system.

20386 **(EPRI-EA—3410) Survey of conditional energy demand models for estimating residential unit energy consumption coefficients. Final report.** Lawrence, A.G.; Parti, M. (Angel Economic Reports, Cupertino, CA (USA); Applied Econometrics, Inc., Del Mar, CA (USA)). Feb 1984. 176p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

Several recent econometric studies of residential energy use are reviewed. These studies specify residential energy use as the sum of energy use in each of several household appliances (including space conditioning systems). The energy used in each of the enumerated appliances (e.g., end-uses) is called its unit energy consumption (UEC) coefficient. Most of the studies use household survey data combined with utility billing records. In general, the UEC coefficients are parameterized as functions of weather conditions, household income, the size of the dwelling, the demographic composition of the household, the price of energy, and other variables from the survey data. A few of the studies have explored the econometric issues of demand analysis under the block tariff schedules prevalent in the utility industry. Some studies report price elasticities or income elasticities or both for specific end-uses. These studies show that such econometric estimation is a successful and efficient tool for measuring electricity consumption by end-use. Their results are compared with engineering estimates from other extant studies. Results from these econometric UEC models have improved the accuracy and end-use detail of the energy forecasting models of some utilities.

20387 **(LBL—15382) Field study on occupancy scheduling as a lighting management strategy.** Rubinstein, F.; Karayel, M.; Verderber, R. (Lawrence Berkeley Lab., CA (USA)). Apr 1983. Contract AC03-76SF00098. 29p. (CONF-8308163—1; EEB-L—83-08). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009238.

From Annual Illuminating Engineering Society conference; Los Angeles, CA, USA (8 Aug 1983).

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Experimental results from a major demonstration of an advanced lighting energy management system at the World Trade Center are presented. The energy-saving benefits of automatically scheduling the operation of the lighting system to conform to occupancy patterns are examined. The energy saved by scheduling was measured by comparing lighting energy consumption without scheduling to consumption with scheduling. The benefits of a variety of switching scheduling are compared and the relationship between energy savings and sector size discussed. Using a loose automatic schedule with 1000 ft^2 zones, lighting energy consumption was reduced by 30% relative to baseline consumption. With a tighter schedule, energy consumption was reduced 36 to 37%. Based on a simple economic analysis, scheduling is shown to be a cost-effective strategy for reducing energy consumption in buildings.

20388 **(LBL—16036) Calculation of natural ventilation and comfort.** Sherman, M.; Ashley, S. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 33p. (CONF-840124—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009215.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting; Atlanta, GA, USA (29 Jan 1984).

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Natural ventilation can be used to greatly reduce cooling loads and increase human comfort in buildings in hot, humid climates. Airflow rates directly affect a building's heat balance by removing internal gains and directly affect comfort levels by increasing the body's convective and evaporative heat-transfer coefficients; these airflow rates are determined by the wind pressure on the faces of the building (which is calculated from the wind speed and pressure coefficient) and the amount of open area. Wind pressure coefficients can be obtained in three ways: (1) by direct field measurement, (2) by scale-model experiments in a wind-tunnel, and (3) by comparison with standard wind-tunnel data. Measurements made on two buildings at the Kaneohe Marine Corps Air Station (KMCAS) on the island of Oahu, Hawaii, during the summer of 1982 are described. These full-scale measurements of pressure coefficients will be compared to reduced-scale measurements made at the the boundary-layer wind-tunnel at the Naval Civil Engineering Laboratory (NCEL). Estimates of the indoor comfort levels for different window conditions will be used as a basis for determining the acceptability of natural ventilation for cooling.

20389 **(NP—4770180) Floors and ceilings with floor heating systems.** Oswald, R. (Bundesministerium fuer Raumordnung, Bauwesen und Staedtebau, Bonn (Germany, F.R.)). 1983. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770180.

Report on the present state of technical knowledge about adequate thermal insulation and construction of components with floor heating. Special interest is given to effects that floor heating systems may have on adjacent components. Possible solutions are indicated, and unsolved questions are mentioned. Temperatures occuring in the ambient area of floor heating systems are surveyed and listed, they are used for a control review of the present thermal insulation for components with floor heating systems in various ways of installation. Aspects of building and construction focus on: choice of material, dimensioning, thermal insulation layers; thermal insulation; function, need and design of insulating layer covering; floor topping and the floor coverings above the topping; problems of sealing.

20390 **(ORNL/CON—141) Preliminary assessment of decentralized small cogeneration for Navy shore bases.** McCold, L.N.; Karnitz, M.A. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008223.

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As part of an effort to reduce energy consumptions, the Navy is examining new energy conservation technologies. This study assesses the potential use of small cogeneration equipment in decentralized locations on Navy shore facilities. For the purposes of this study, small cogeneration includes packaged, preengineered cogeneration systems with electric generating capacities below about 500 kW. Decentralized applications are those uses at individual buildings or building complexes. The characteristics of the available small cogeneration equipment are collected and summarized. The available energy use data on hospitals, unaccompanied enlisted personnel housing (UEPH) and unaccompanied officer housing (UOPH) at four Navy bases are analyzed. A method for applying small cogeneration equipment to buildings is developed and used. The energy and economic characteristics of these applications are summarized and discussed. Four economically attractive decentralized small cogeneration applications are identified, and the conditions under which other attractive applications are likely to be found are discussed. The principal uncertainties about this technology are the performance and reliability to be expected from the available equipment.

20391 **(ORNL/CON—149) Theoretical analysis of a kinematic Stirling-cycle heat pump for space conditioning applications.** Domingo, N.; Jackson, W.L.; Chen, F.C. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84010240.

A computer simulation was performed for a kinematic Stirling-cycle heat pump (modified from the GPU-3 heat engine mode) using the NASA Lewis Research Center (LERC) third-order code, which employs nodal analysis to solve numerically the governing differential equations. Parametric and sensitivity analyses were carried out to determine the effects of outdoor air (source) temperature, mean compression-space pressure, crank speed, and heat exchanger design parameters on the performance of the Stirling-cycle heat pump. For the modified Stirling-cycle heat pump, the indicated heating coefficient of performance (COP), which excluded mechanical and parasitic losses, ranged from 2.14 to 2.53 for outdoor air temperatures between 255.2 K (0°F) and 281.3 K (47°F), respectively. It was determined from the parametric study that, unlike typical vapor compression cycles, the Stirling-cycle COP and heat capacity were relatively insensitive to outdoor air temperature. These results suggest the possible application of the Stirling-cycle heat pump in colder climates.

20392 **(PB—84-141720) Damper characteristics for ducted air systems: a preliminary study. Technical memo.** Legg, R.C. (Polytechnic of the South Bank, London (UK). Inst. of Environmental Science and Technology). May 1981. 68p. (TM—80). NTIS, PC E05/MF E05.

The need for dampers as flow control devices in ventilation and air conditioning systems is discussed. A literature survey revealed little reliable data on their characteristics. This preliminary report describes a study made into some aspects of their performance.

20393 **(PB—84-143098) Effect of water quality on residential water-heater life-cycle efficiency. Annual report Sep 82-Aug 83.** Stickford, G.H.; Talbert, S.G.; Vigon, B.W.; Miller, J.F.; Locklin, D.W. (Battelle Columbus Labs., OH (USA)). 30 Sep 1983. 59p. (N—4186). NTIS, PC A04/MF A01.

A 3-year field test program is underway for the Gas Research Institute to quantify the effect of scale buildup on the performance of residential water heaters, and to determine the benefits and limitations of common water treatment methods. In this program, the performance of gas and electric heaters will be monitored in test laboratories set up in selected U.S. cities. The test will monitor the efficiency of heaters operating on hard water and compare the performance with heaters operating on treated water. Corrosion tests will also be conducted on each type of water tested to determine the effect of water treatment on the corrosion of the water heating system. Recovery efficiency measurements and service or operating efficiency measurements have been made on each of the heaters during the course of the tests. These preliminary results, simulating 1-year of operation, indicate no measureable degradation of heater efficiency due to a small amount of scale buildup.

20394 **(PB—84-144435) Introduction to the mathematical modelling of air conditioning systems. Technical memo.** James, R.W. (Polytechnic of the South Bank, London (UK). Inst. of Environmental Science and Technology). Jul 1980. 30p. (TM—76). NTIS, PC E04/MF E04.

A mathematical model of an air conditioning system is derived using established techniques and is used to investigate the influence of control parameters. It is concluded that further research into the derivation and application of models is required.

20395 **(PB—84-148071) Phase II development Brayton/Rankine 10-ton gas-fired space conditioning program. Annual report No. 3, Jan-Dec 82.** (AiResearch Mfg. Co., Torrance, CA (USA)). May 1983. 132p. (R—83-19892). NTIS, PC A07/MF A01.

The purpose of the report is to develop, demonstrate performance, and assess the market potential of a light-commercial-size (10-ton) heat pump powered by a natural gas-fired Brayton cycle engine. In the space-conditioning field, heat pumps driven by electric motors have been successfully marketed as energy-saving systems. By the use of efficient on-site power generation, however, the performance of heat pump systems can be improved significantly. A natural-gas-powered engine directly driving the heat pump utilizes the waste heat from the building for space heating or other uses, such as water heating. The utilization of an efficient gas-powered engine drive can reduce energy consumption in both heating and cooling and thus reduce energy usage for the utility and operating costs for the individual rate payer. An efficient system can more than pay for itself over its lifetime with annual cost savings. The challenge is to develop an efficient gas-fired, space-conditioning system that will also meet the demands of the marketplace, including low initial costs, high reliability, and minimum maintainability requirements.

20396 **(SERI/SP—254-1788) Residential retrofit specification/cost data base.** (Solar Energy Research Inst., Golden, CO (USA)). Nov 1982. Contract AC02-83CH10093. 207p. NTIS, PC A10/MF A01; GPO Dep. Order Number DE84010018.

This manual contains technical specifications for approximately 60 residential variations of energy conservation retrofits and cost estimates for each of these retrofits in 56 cities. Costs are provided on a contractor-installed basis for each retrofit and on a resident-installed basis where appropriate. The manual includes two major sections. The first section contains specifications for the conservation measures. The second section contains costs for each of those measures by city. The costs are based on October 1982 prices. For each measure, a listing of materials and installation techniques is provided.

3202 Transportation

REFER ALSO TO CITATION(S) 20376

20397 **(DOE/NBM—4009183) Motor vehicle MPG and market shares report. MPG and market share data system, model year 1983.** Hu, P.S.; Roberts, G.F. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009183.

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Estimates of final model year 1983 new car and new light truck MPG are provided. ORNL has modified the procedure for calculating new car MPG. The new procedure takes into account the sales mix of engine size, engine type (gasoline or diesel), and transmission type within a nameplate (car line). For example, the new ORNL method takes into account that over 60 percent of the Chevettes in 1983 were the gasoline version (98 CID engine displacement) with a 3-speed automatic transmission. Also, the three diesel model types accounted for only about 1 percent of the Chevette sales. This new method estimated the Chevette MPG for 1983 to be 33.2, nearly 5 MPG lower than the estimate based on the old method. Since this report contains revised new car MPG estimates for every year, the fuel economy estimates in this report are not comparable to those in any previous ORNL report. The estimates of new light truck MPG have not been revised, however.

20398 **(PB—84-122290) Highway statistics 1982.** (Federal Highway Administration, Washington, DC (USA). Office of Highway Planning). 1983. 192p. NTIS, PC A09/MF A01.

This publication was prepared by the Highway Statistics Division, Office of Highway Planning, Federal Highway Administration. The 38th of an annual series, it presents the 1982 analyzed statistics of general interest on motor fuel, motor vehicles, driver licensing, highway-user taxation, State highway finance, highway mileage, and Federal aid for highways; and 1981 highway finance data for municipalities, counties, townships, and other units of local government. A listing of the data is given in the table of contents and a brief description is given in the text accompanying each section.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 19642, 19671, 19939, 20421

20399 **(DOE/BP—228) Application of thermal energy storage to process heat recovery. Final report, Phase III. Heat exchanger evaluation.** (Rocket Research Co., Redmond, WA (USA)). 16 Sep 1983. 84p. NTIS, PC A; 3; GPO Dep. Order Number DE84009034.

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A prototype heat exchanger built to extract heat from the waste gas at the Intalco Aluminum Corporation aluminum smelter plant and transfer it to water is described. The following results were obtained: carbon steel finned tube design is appropriate for the heat exchanger. No corrosion of the steel was observed on the gas side. Fouling by particulate matter on the gas side did occur, but was controlled by sootblowing. The sustainable heat transfer rate was 877,000 BTU/hr. For a public agency, the estimated cost of heat obtained from the prototype heat exchanger is $3.58/million BTU. For a private corporation, this cost is $13.10/million BTU. For a full-scale heat exchanger suitable for a district heating system, the above costs are estimated as $1.25/million BTU and $4.01/million BTU. The difference between the public and private costs is due to taxes and the short payback time required in the pri-

vate case. These costs assume year-round full output operation. They also do not include costs of transmission equipment and charges levied by the supplier of the waste gas. The above costs are in the same range as other current fuel costs.

20400 **(DOE/CE/40558—T1) Recovery and reuse of asphalt roofing waste. Final report.** Desai, S.; Graziano, G.; Shepherd, P. (Manville Service Corp., Denver, CO (USA). Research and Development Center). 2 Feb 1984. Contract AC07-82CE40558. 75p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009368.

Burning of asphalt roofing waste as a fuel and incorporating asphalt roofing waste in bituminous paving were identified as the two outstanding resource recovery concepts out of ten studied. Four additional concepts might be worth considering under different market or technical circumstances. Another four concepts were rated as worth no further consideration at this time. This study of the recovery of the resource represented in asphalt roofing waste has identified the sources and quantities of roofing waste. About six million cubic yards of scrap roofing are generated annually in the United States, about 94% from removal of old roofing at the job site and the remainder from roofing material production at factories. Waste disposal is a growing problem for manufacturers and contractors. Nearly all roofing waste is hauled to landfills at a considerable expense to roofing contractors and manufacturers. Recovery of the roofing waste resource should require only a modest economic incentive. The asphalt contained in roofing waste represents an energy resource of more than 7×10^{13} Btu/year. Another 1×10^{13} Btu/year may be contained in field-applied asphalt on commercial building roofs. The two concepts recommended by this study appear to offer the broadest applicability, the most favorable economics, and the highest potential for near-term implementation to reuse this resource.

20401 **(DOE/CS/15058—T1) Direct current electrical heat treatment. Final performance (technical/progress) report.** Dolan, J.J. (ValJim Corp., Westport, CT (USA)). 8 Mar 1984. Contract FG01-81CS15058. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009365.

Progress is reported on the following for a steel plant: marketing study, cost study, operating manual, detailed engineering drawings, and the detailed equipment proposal for complete line. (MHR)

20402 **(DOE/CS/40175—T1) Demonstration of the Environmental Data Corporation Spectral Fuel Conservation System.** (Exxon Research and Engineering Co., Florham Park, NJ (USA); Environmental Data Corp., Monrovia, CA (USA)). 1984. Contract AC02-76CS40175. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009425.

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The test of a combustion control system, the Spectral Fuel Conservation System (SFCS), designed to automate low excess air firing with balanced burner operation has been conducted on an industrial boiler. The test was conducted on a four burner industrial boiler owned by Kerr-McGee Chemical Corporation in Trona, California. The boiler was fired with oil for the test. The basic elements of the SFCS are the Spectral Flame Analyzer (SFA), an in-stack CO monitor, control hardware and logic circuitry. The SFAs, one per burner, (sighting directly a luminous species in the flame and acting in conjunction with logic circuitry) are designed to issue a signal to control valves which vary the fuel flow so that all burners are balanced. The in-stack CO analyzer signal is used to reduce the excess oxygen in the boiler to as low a level as is practical. Balanced burners should enable a lower excess oxygen level to be realized than would be possible with unbalanced burners. Generally, the lower the excess oxygen level the greater the fuel savings. A limited proof of concept test of the SFCS was undertaken. This test determined SFA response to excess oxygen changes, evaluated the burner balancing capability of the SFA control loop, and used the CO loop to control overall excess oxygen. Complete closed loop operation of the boiler by the SFCS was accomplished.

20403 **(DOE/CS/40229—T1) Industrial Cogeneration Optimization Program. Final report.** Burnworth, H.F. Jr. (TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.; Thermo Electron Corp., Waltham, MA (USA)). Sep 1979. Contract AC01-78CS40229. 498p. NTIS, PC A21/MF A01; 1; GPO Dep. Order Number DE84009167.

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The study program described, the Industrial Cogeneration Optimization Program (ICOP), is a part of the DOE Integrated Industry Cogeneration Program to optimize, evaluate, and demonstrate cogeneration systems, with direct participation of the industries most affected. Specifically, the primary objectives of ICOP were to: characterize five major energy intensive industries with respect to their energy use profiles. (The industries were: petroleum refining and related industries, textile mill products, paper and allied products, chemicals and allied products, and food and kindred products.); and select optimum cogeneration systems for site-specific reference case plants in terms of maximum energy savings subject to given return on investment (ROI) hurdle rates. In accomplishing these objectives, analyses were made that define the range of optimal cogeneration systems for each reference case plant considering technology applicability, economic factors, and energy savings by type of fuel. This study also provides guidance to other parts of the Industrial Conservation Program through information developed with regard to component development requirements, institutional and regulatory barriers, as well as fuel use and environmental considerations.

20404 **(DOE/R5/10302—T1) All wood briquet. Final report.** Biehl, B. (Milltown Products, Paradise, MI (USA)). 1984. Contract FG02-81R510302. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007971.

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The main objectives of this grant was the development of a product and a device, the demonstration of the device and product with the ultimate goal being the commercialization of one or both. The device, a residue fired burner, residue being sawdust in this case, was constructed and tested with favorable results but the lack of sufficient funds prevented its development. The product, an All Wood Briquet, subsequently called the Milltown Loggett, was successfully refined and demonstrated. A business plan including financing, marketing and production has been prepared and is presently being implemented to place the Milltown Loggett into commercial production. Unfortunately we were not able to complete the project goals during the grant period nor was the funding sufficient. The project was more costly, more complicated and took much longer than anticipated, but with that DOE assistance the desired goal was achieved; that is a good, safe, clean environmentally sound commercial product for the consumer market and the creation of new jobs in an economically depressed area.

20405 **(DOE/R7/01136—T1) Natural draft aeration of stored grain. Final quarterly progress report, No. 4.** Stewart, W.E. Jr. (Oak Ridge Associated Universities, Inc., TN (USA)). 26 Feb 1982. Contract FG47-80R701136. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007858.

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It was discovered early in this work that wind induced flow would be of a much larger magnitude than natural draft induced air flow and has therefore been the subject of the rest of this effort. A computer program was written to approximate the amount of cooling done due to wind induced air flow through a grain bin filled with corn. The computer program has several features, the results of which are applicable to various bin diameter sizes. The computer program models the amount of air passing through a grain bin filled with corn. The greater the wind velocity, the greater the air flow through the bin. The program also models the size of an inlet duct to the bottom of the bin, as the larger the duct diameter the greater the air flowrate. Four quarterly progress reports are included.

20406 **(DOE/R7/01169—T1) Energy savings through improved irrigation practices. Final report.** Gilley, J.R.; Supalla, R.J. (Gilley Engineering, Inc., Lincoln, NE (USA)). 31 Jul 1981. Contract FG47-80R701169. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84010007.

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In view of importance of energy to irrigated agriculture, the objectives of this project were: (1) determine the potential energy savings from alternative irrigation management practices; and (2) evaluate the economic benefits which would occur to irrigators from adopting these energy saving practices. These objectives were pursued for a selected array of irrigation situations typical of DOE Region VII. The analysis consists essentially of three parts, including the potential for improved energy efficiency with surface irrigation systems (gated pipe), the potential for enhanced energy efficiency with sprinkler systems, and a comparison of alternative irrigation systems. For gated-pipe surface systems, the energy conservation alternatives considered were: (1) increasing pump performance; (2) improving irrigation efficiency; and (3) water management. The alternatives considered for center-pivot sprinkler systems included conversion to low pressure, as well as pump performance, irrigation efficiency and water management. The analysis of alternative systems involved computing the energy and dollar savings associated with shifting from gated-pipe to one of four types of sprinkler systems: high-pressure center-pivot, low-pressure center-pivot, corner center-pivot, and continuous move lateral. The above alternatives were analyzed for an array of given conditions. These included combinations of three lifts (8, 35 and 75 meters) and two net irrigation requirements (33 to 66 cm for surface system and 25 and 50 cm for sprinkler systems). These conditions encompass nearly the full range of circumstances found in DOE Region VII.

20407 **(NP—4900828) Feasibility of utilizing apple pomace.** Stapleton, J. (Hudsonia Ltd., Annandale, NY (USA)). Jun 1983. 212p. NTIS, PC A10/MF A01. Order Number DE84900828.

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Apple pomace, the solid residue from juice production, is a solid waste problem in the Hudson Valley. This study investigates possibilities for converting it to a resource. The characteristics of the region's apple growing and processing industries are examined at length, including their potential for converting waste biomass. The properties of apple pomace are described. From interviews with Hudson Valley apple processors the following information is presented: quantities of pomace produced; seasonality of production; disposal procedures, costs, and revenues; trends in juice production; and attitudes toward alternatives. Literature research resulted in a list of more than 25 end uses for apple pomace of which eight were selected for analysis. Landfilling, landspreading, composting, animal feed, direct burning, gasification, anaerobic digestion (methane generation), and fermentation (ethanol production) were analyzed with regard to technical availability, regulatory and environmental impact, attitudes toward end use, and energetic and economic feasibility (See Table 19). The study recommends (1) a pilot anaerobic digestion plant be set up, (2) the possibility of extracting methane from the Marlborough landfill be investigated, (3) a study of the mid-Hudson waste conversion potential be conducted, and (4) an education program in alternative waste management be carried out for the region's industrial and agricultural managers.

20408 **(PB—84-143015) Investigation into oil circulation and recovery in a refrigeration system. Technical memo.** Welch, T.C.; Saluja, S.N.; James, R.W. (Polytechnic of the South Bank, London (UK). Inst. of Environmental Science and Technology). Mar 1979. 33p. (TM—64). NTIS, PC E04/MF E04.

A mathematical model of an experimental refrigeration system incorporating a liquid separator and flooded evaporator, compressor and a shell and tube condenser was derived and gives good information on the movement of the refrigerant and oil inside the system for miscible refrigerants. The model is used to investigate oil recovery systems.

20409 **(PB—84-143841) Prediction of pressure drops accompanying the evaporation of refrigerants inside horizontal tubes. Technical memo.** Stoneham, H.G.; Saluja, S.N.; Dunn, A. (Polytechnic of the South Bank, London (UK). Inst. of Environmental Science and Technology). Jan 1980. 41p. (TM—71). NTIS, PC E04/MF E04.

Four of the more widely used correlations for the prediction of pressure drops were compared with published experimental data using statistical techniques. None of the correlations examined were found to be suitably accurate over the range of conditions normally encountered in direct expansion evaporators. A new correlation was developed and is presented here, that can be used with an acceptable degree of accuracy by the design engineer. The correlation is presented in a form that can be easily written into a program for solution on a programmable calculator leading to quick and accurate evaluation of the pressure drop that accompanies a refrigerant evaporatoring inside a horontal tube evaporator.

20410 **(PB—84-144732) Development of a mathematical model of refrigeration system. Technical memo.** Welch, T.C.; Saluja, S.N.; James, R.W. (Polytechnic of the South Bank, London (UK). Inst. of Environmental Science and Technology). Dec 1978. 48p. (TM—61). NTIS, PC E04/MF E04.

A mathematical model of an experimental refrigeration system incorporating a liquid separator and flooded evaporator, compressor and a shell and tube condenser was derived as a design aid. This model, which gives dynamic and steady state responses has subsequently been developed and now gives good information on the movement of the refrigerant inside the system. The responses from the model show good agreement with experimental data.

20411 **(PB—84-148097) Industrial compact ceramic finned-plate recuperator. Annual report Aug 82-Jul 83.** Coombs, M.; Strumpf, H.; Kotchick, D. (AiResearch Mfg. Co., Torrance, CA (USA)). Aug 1983. 157p. (R—83-20289). NTIS, PC A08/MF A01.

The purpose of this project is to develop a ceramic finned-plate recuperator to recover and utilize the waste heat contained in high-temperature industrial furnace flue gases. Thousands of natural gas-fired industrial furnaces operate at temperatures in excess of 2000F. Of the energy used in these furnaces, only a small fraction provides actual heating of the products. Most of the energy is contained in the high-temperature flue gases, which normally escape into the atmosphere. This energy can be recovered by use of a recuperator (i.e., heat exchanger) wherein the heat energy in the flue gases is recycled to the furnace by heating the cold incoming combustion-air stream. For gas-fired systems, thermal efficiency improvements of up to 50 percent are possible using high-temperature recuperators.

20412 **(PNL—4850) Cogeneration handbook for the petroleum refining industry.** Fassbender, L.L.; Garrett-Price, B.A.; Moore, N.L.; Fassbender, A.G.; Eakin, D.E.; Gorges, H.A. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 157p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84009962.

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The decision of whether to cogenerate involves several considerations, including technical, economic, environmental, legal, and regulatory issues. Each of these issues is addressed separately in this handbook. In addition, a chapter is included on preparing a three-phase work statement, which is needed to guide the design of a cogeneration system. In addition, an annotated bibliography and a glossary of terminology are provided. Appendix A provides an energy-use profile of the petroleum refining industry. Appendices B through O provide specific information that will be called out in subsequent chapters.

20413 **(PNL—4852) Cogeneration handbook for the pulp and paper industry.** Griffin, E.A.; Moore, N.L.; Fassbender, L.L.; Garrett-Price, B.A.; Fassbender, A.G.; Eakin, D.E.; Gorges, H.A. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 151p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84010236.

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The decision of whether to cogenerate involves several considerations, including technical, economic, environmental, legal, and regulatory issues. Each of these issues is addressed separately in this handbook. In addition, a chapter is included on preparing a three-phase work statement, which is needed to guide the design of a co-

generation system. In addition, an annotated bibliography and a glossary of terminology are provided. Appendix A provides an energy-use profile of the pulp and paper industry. Appendices B and O provide specific information that will be called out in subsequent chapters.

20414 **(PNL—4855) Cogeneration handbook for the chemical process industries.** Fassbender, A.G.; Fassbender, L.L.; Garrett-Price, B.A.; Moore, N.L.; Eakin, D.E.; Gorges, H.A. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84010235.

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The desision of whether to cogenerate involves several considerations, including technical, economic, environmental, legal, and regulatory issues. Each of these issues is addressed separately in this handbook. In addition, a chapter is included on preparing a three-phase work statement, which is needed to guide the design of a cogeneration system. In addition, an annotated bibliography and a glossary of terminology are provided. Appendix A provides an energy-use profile of the chemical industry. Appendices B through O provide specific information that will be called out in subsequent chapters.

20415 **(PNL—4910) Identification of existing waste heat recovery and process improvement technologies.** Watts, R.L.; Dodge, R.E.; Smith, S.A.; Ames, K.R. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84008525.

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General information is provided on waste heat recovery opportunities. The currently available equipment for high- and low-temperature applications are described. Other equipment related to wasteheat recovery equipment such as components, instruments and controls, and cleaning equipment is discussed briefly. A description of the microcomputer data base is included. Suppliers of waste heat equipment are mentioned throughout the report, with specific contacts, addresses, and telephone numbers provided in an Appendix.

20416 **(PNL—5061) Survey and analysis of materials research and development at selected federal laboratories.** Reed, J.E.; Fink, C.R. (Energetics, Inc., Columbia, MD (USA)). Apr 1984. Contract AC06-65RL01830. 145p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84008904.

This document presents the results of an effort to transfer existing, but relatively unknown, materials R & D from selected federal laboratories to industry. More specifically, recent materials-related work at seven federal laboratories potentially applicable to improving process energy efficiency and overall productiviy in six energy-intensive manufacturing industries was evaluated, catalogued, and distributed to industry representatives to gauge their reaction. Laboratories surveyed include: Air Force Wright Aeronautical Laboratories Material Laboratory (AFWAL). Pacific Northwest Laboratory (PNL), National Aeronautics and Space Administration Marshall Flight Center (NASA Marshall), Oak Ridge National Laboratory (ORNL), Brookhaven National Laboratory (BNL), Idaho National Engineering Laboratory (INEL), and Jet Propulsion Laboratory (JPL). Industries included in the effort are: aluminum, cement, paper and allied products, petroleum, steel and textiles.

20417 **Energizing American industry for global competition.** Barker, B. *EPRI (Electric Power Research Institute) Journal;* **8**: No. 12, 17-25(Dec 1983).

A meeting of the Electric Power Research Institute (EPRI) Advisory Council and guests from basic industries provided a forum on transition in American manufacturing. The worldwide automation imperative has profound implications for energy and labor. Among the concerns raised were the sense that the US is still holding to its notion of a closed economy, the diminished role of manufacturing in the US economy, and two central questions: where is energy consumption headed, and can electricity or electric-based technologies play a role in the revitalization: EPRI's major role is developing and transferring new technologies to the utilities. 1 figure, 1 table.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 19890, 20821

20418 **(DOE/CS/20245—T1) Demonstration of synergistic industrial energy/municipal solid waste disposal facility report. Phase I. Volume I.** (Delaware, County of, Media, PA (USA); Scott Paper Co., Chester, PA (USA); Weston (Roy F.), Inc., West Chester, PA (USA)). Nov 1979. Contract FG01-79CS20245. 163p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84009518.

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The proposed resource recovery project will consist of a facility for combustion of solid waste, and the generation of steam; including recovery of residual materials, satisfactory disposal of the remaining ash, and provisions for continuity of operation in the event of interruption in the waste stream, or interruption in the use of steam from the project. Scott paper has electrical generating equipment currently operating which will be utilized and augmented, if feasible, by additional generating capacity. In addition to steam from solid waste, Scott is also investigating coal as an alternative to burning No. 6 fuel oil, which will require major modifications to existing facilities or the construction of a new steam generating plant. Concepts considered in this study involve cofiring solid waste with coal, and the generation of steam from municipal solid waste only.

20419 **(DOE/ID/12163—1) Waste tire fluidized bed combustion boiler project.** (National-Standard Co., Niles, MI (USA)). Mar 1984. Contract FC07-80ID12163. 323p. NTIS MF A01; 2; GPO Dep. Order Number DE84008535.

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The objective was to commercially demonstrate a fluidized bed combustion (F.B.C.) system that could convert waste tires into steam energy at a convenience level approximately that of oil or gas-fired boilers. In order to burn tires in a F.B.C. unit, the tires must first be chopped into a maximum size of four inches by four inches. This was readily accomplished in a tire chopper modified for multi-pass operation. The chopper could be mounted on a truck or trailer and use gasoline or other fuels making it suitable for mobile operation. A test program was conducted to determine performance and design criteria, which were used to specify a commercial scale steam generation demonstration unit. It was found that 100% of the heat of combustion available in tires can be released in a F.B.C. unit. Tires must be combusted at 775 +- 25°C to provide for fiberglass removal. Unburned carbon black along with fiberglass, zinc oxide, bed fines and scrap wire would have to be landfilled. Sulfur dioxide and nitrogen oxide emissions would be below the limits imposed by the Michigan Department of Natural Resources. Particulate emissions downstream of the cyclone would have to be limited by some system such as a bag house. A site was prepared for the pilot model site at National-Standard Lake Street Plant Building No. 6 in Niles, Michigan. The tire chopper and most of the auxiliary equipment was installed. Before contracts were awarded to construct the F.B.C. unit, a revised financial analysis showed that the investment required for the F.B.C. unit made the entire system uneconomical. Although the operating costs of the waste tire system was considerably less than that of gas or oil fired boilers, the large initial investment for the system made the payback period 12 to 18 years.

20420 **(DOE/R7/01022—T1) Feasibility of methane production from rural landfills. Final report.** Gaddy, J.L. (Arkansas Univ., Fayetteville (USA). Dept. of Chemical Engineering). Jan 1982. Contract FG47-79R701022. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007752.

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The Kaysinger Basin Region (KBR) consists of seven counties and fifty-one communities in western Missouri. The technical

and economic feasibility of producing methane from a centralized landfill in the KBR are investigated. The following are included: description of the Kaysinger Basin Region, analysis of the solid waste volume and transportation cost, gas generation studies, and economic analysis. (MHR)

20421 **(PB—84-148089) Packaged high-efficiency gas turbine cogeneration system. Final report on Phase 1, Jan-Jun 83.** Cohoe, W.F.; Kimball, J.G. (AiResearch Mfg. Co., Torrance, CA (USA)). 15 Jul 1983. 108p. (R—83-20022). NTIS, PC A06/MF A01.

A study has been performed to examine the potential applicability of a 500-Kw gas turbine cogeneration system to a broad market. The thrust of the study is to determine if a prepackaged production hardware system can enjoy a sufficient market to justify its production design. The study identifies the size of the potential market, selects a specific hardware configuration, and analyzes certain specific installations for the economic tradeoffs. The results indicate a very positive potential for this prepackaged cogeneration system approach.

20422 **Fuel-supply management: charting a course through uncertainty.** Douglas, J.; Dalton, S.; Dene, C. *EPRI (Electric Power Research Institute) Journal;* **8**: No. 12, 6-13(Dec 1983).

Fuel planners must pilot utilities through a sea dotted with economic and regulatory unknowns. With the added threat of supply disruptions, utilities need better analytic tools and more-flexible procurement and inventory strategies to keep the cost of boiler fuels in line. The Energy Resources Program is responding with new projects to help utilities integrate fuel and investment decisions and improve inventory planning. 3 references, 5 figures.

20423 **Pulsed-flow air classification for waste-to-energy.** Stessel, R.I. (Dept. of Civ. and Environmental Engrg., Duke Univ., Durham, NC 27706). *Journal of Solar Energy Engineering;* **109**: No. 2, 60-73(Jun 1983). Contract AC05-79CS20544.

The development and testing of the concept of pulsed-flow air classification for waste-to-energy production are discussed. Air classifiers, a potentially valuable unit operation in waste-to-energy production facilities, currently do not meet expectations. Standard designs generally lose large amounts of combustible material as well as produce a fuel that is high in metal and glass contaminants. Pulsed-flow classification is presented as a concept which can avoid both pitfalls. Municipal solid waste (MSW) is composed of particles which can be cataloged as combustible and non-combustible fractions by defining a density split between aluminum and plastic: generally all other non-combustibles are more dense than aluminum, while all other combustibles are less dense than plastic. However, current designs for classifiers tend to separate by aerodynamic characteristics which do not always produce a split based on density alone. Pulsed-flow classifiers are seen to offer a unique solution to this puzzle. In this paper, each aspect of theory and laboratory testing is presented, including: Preliminary determination; particle characteristics; theory of pulsed-flow classification; experimental equipment; laboratory testing; and pulsed-flow air classification for energy production. Conclusions from the research are summarized in the final section of the paper.

3209 Education And Public Relations

20424 **(DOE/CS/69031—T1) Energy Extension Service non-pilot states grants program. Final progress report.** Westerberg, B.M. (Energy Management Associates, Bismarck, ND (USA)). 1984. Contract FG01-78CS69031. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009364.

The events and activities undertaken by the state of North Dakota during the program are summarized. The lessons learned from the Pilot Program and how the state utilized these lessons are described. The problems and difficulties encountered by the state in preparing for the Energy Extension Service National Program, and the ways in which these problems were overcome are discussed briefly.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 20441

3303 Electric-powered Systems

20425 **(DOE/CS/54270—T1) Field test and demonstration of an electric vehicle. Final report.** McDonald, A.T.; Ogborn, L.L. (Purdue Univ., Lafayette, IN (USA). Inst. for Interdisciplinary Engineering Studies). 31 Dec 1979. Contract FG01-78CS54270. 5p. NTIS, PC A02; 3; GPO Dep. Order Number DE84010020.

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A limited field test and demonstration program was conducted on a Jet Industries Electra-Van 600 electric vehicle. Numerous problems were encountered with weather, vehicle reliability, and driver reactions. These problems prevented accomplishing all of the original objectives of the test and demonstration program. However, important practical experience was gained in designing and operating such programs. The report summarizes the results and lessons learned.

3308 Alternative Fuels

20426 **(DOE/CS/50003—1) Performance evaluation of alcohol-gasoline blends in 1980 model automobiles. Phase II. Methanol-gasoline blends.** (Coordinating Research Council, Inc., Atlanta, GA (USA)). Jan 1984. Contract AC03-79CS50003. 192p. NTIS, PC A09; 3; GPO Dep. Order Number DE84008907.

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A test program designed to define the emissions, fuel economy, drive-ability, and vapor lock characteristics of both simple and volatility-adjusted ethanol-gasoline (Phae I) and methanol-gasoline (Phase II) blends versus gasoline was conducted. The fuels were tested in 1980 model-year cars representing various emisson-control technologies using test procedures accepted by the federal government and industry. This report details the methanol-gasoline blends portion of the program. Six unleaded fuels were used for this phase of the program: a reference gasoline and five methanol blends. The methanol-gasoline blends had oxygen contents ranging between 1 and 8 weight percent, and included fuels with and without isobutanol co-solvent. Ten of the fourteen 1980 model cars from the Phase I portion of the program were re-used in Phase II, following renovation, re-inspection, and acceptance by CRC. The study showed that methanol in gasoline affected most vehicle performance parameters. Organic and carbon monoxide tailpipe emissions were reduced, but effects on other emissions, driveability, and fuel economy were generally adverse with methanol at the higher concentrations. Another experimental program is needed to define the response of vehicle performance factors to fuel characteristics such as oxygen content and volatility, which this program strongly suggests are the two most influential on vehicle performance.

20427 **(DOE/ET/12178—T1) Performance of a diesel engine operating on raw coal-diesel fuel and solvent refined coal-diesel fuel slurries. Final report.** Marshall, H.P. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Coll. of Engineering). Mar 1980. Contract AS01-78ET12178. 101p. NTIS MF A01; 2; GPO Dep. Order Number DE84009375.

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Performance tests using an 11 kw single cylinder diesel engine were made to determine the effects of three different micronized coal-fuel oil slurries being considered as alternative fuels. Slurries containing 20, 32, and 40 percent by weight micronized raw coal in No. 2 fuel oil were used. Results are presented indicating the changes in the concentrations of SO/sub X/ and NO/sub X/ in the exhaust, exhaust opacity, power and efficiency, and in

wear rates relative to operation on fuel oil No. 2. The engine was operated for 10 hrs at full load and 1400 rpm on all fuels except the 40% by weight slurry. This test was discontinued because of extremely poor performance.

20428 **(DOE/R7/01140—T1) Sunflower seed oil: automotive fuel source. Final technical report.** Denny, W.M. (DENCO Mfg. Co., Inc., Springfield, MO (USA)). 1984. Contract FG47-80R701140. 44p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007859.

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The intent of this portion of the project has to demonstrate the feasibility of utilizing sunflower seed oil as an alternate fuel for the spark ignition engine. The research was limited to small, one cylinder, air-cooled engines that are very common on the market place. Conventional fuels, such as gasoline, kerosene, diesel fuel blended with the sunflower oil were used. Sunfuel, sunflower oil, is difficult to procure and relatively expensive at approximately $4.00/gal. The research was unconcerned with how readily available or how competitively priced it was against petroleum products. All of the effort was to assume it was available and cost effective. We concentrated on making it burn in the heat engine and achieved it with marginal success. The review of the literature which was carried on concurrently with the research indicates several problems associated with producing Sunfuel.

36 MATERIALS

REFER ALSO TO CITATION(S) 20416, 20444

20429 **(CONF-840397—1) Alloys in energy development.** Frost, B.R.T. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009190.

From G.V. Raynor memorial conference on alloy phases - theory and practice; Birmingham, UK (30 Mar 1984).

The development of new and advanced energy systems often requires the tailoring of new alloys or alloy combinations to meet the novel and often stringent requirements of those systems. Longer life at higher temperatures and stresses in aggressive environments is the most common goal. Alloy theory helps in achieving this goal by suggesting uses of multiphase systems and intermediate phases, where solid solutions were traditionally used. However, the use of materials under non-equilibrium conditions is now quite common - as with rapidly solidified metals - and the application of alloy theory must be modified accordingly. Under certain conditions, as in a reactor core, the rate of approach to equilibrium will be modified; sometimes a quasi-equilibrium is established. Thus an alloy may exhibit enhanced general diffusion at the same time as precipitate particles are being dispersed and solute atoms are being carried to vacancy sinks. We are approaching an understanding of these processes and can begin to model these complex systems.

20430 **(DOE/CE—0078) Energy Materials Coordinating Committee (EMaCC). Annual technical report, fiscal year 1983.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Energy Conversion and Utilization Technologies Div.). Mar 1984. 241p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84010084.

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The following text briefly describes the materials research programs of the Department of Energy. It is organized by office and organizational charts are provided to allow easy identification of the materials research programs of each office. These program descriptions have been prepared from inputs submitted by many different EMaCC members. This report is not a comprehensive summary of the Department's programs, but rather a compilation of the programs of those offices that submitted inputs.

20431 **(DOE/NBM—4009554) Plutonium research program, fiscal year 1970.** (USAEC Plutonium Research Coordinating Committee, Washington, DC). Mar 1970. 92p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84009554.

This report contains a compilation of unclassified plutonium programs underway in FY 1970 in the field of materials science. It includes work in ceramics, metallurgy, solid state physics and physical chemistry. Information on each of the programs is given in five sub-headings: scope of the work; technical effort in manyears; primary class of materials studied; person(s) to contact for further information; and reports and publications. All the work listed is restricted to either research or long range development and not applied or hardware-type projects.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 19606, 19795, 19796, 19797, 19798, 19799, 19800, 19800, 20002, 20016, 20039, 20090, 20091, 20092, 20101, 20102, 20109, 20109, 20110, 20111, 20112, 20115, 20116, 20131, 20132, 20558, 20562, 21427, 21557, 21562, 21593, 21594, 21603

20432 **(AERE-M—3312) Notch toughness variability in A542 steel used in the European Group on Fracture Jsub(1c) round robin programme.** Druce, S.G. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). Apr 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700736.

The through thickness variability of toughness in a 2 1/4 Cr 1Mo steel plate used in the EGF Jsub(1c) round robin has been evaluated using the Charpy impact testing. The results indicate that the toughness properties at the mid thickness position are inferior to those +- 50 mm from this position and that a comparatively large degree of scatter is present at all depth locations. The relevance of these findings to the Jsub(1c) round robin assessment is briefly discussed.

20433 **(BNL—33765) Dynamics of itinerant ferromagnets above T/sub c/.** Shirane, G.; Steinsvoll, O.; Uemura, Y.J.; Wicksted, J. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 22p. (CONF-831187—17). NTIS MF A01; 2; GPO Dep. Order Number DE84002695.

From 29. annual conference on magnetics and magnetic materials; Pittsburgh, PA, USA (8 Nov 1983).

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A review is given of our current studies of the magnetic scattering, above T/sub c/, from Ni, Fe and Fe (4% - Si). Reliable scattering functions S(Q, ω) are obtained up to 50 MeV of energy transfer by combining polarized and unpolarized neutron techniques. Although constant E scans show magnon like peaks in agreement with the previous Oak Ridge data, no peaks are observed in our constant Q scans up to 0.5 A^{-1}, in contrast to the well defined peak reported by Lynn for Fe(12% - Si). Unexpectedly, for a wide temperature range, the scattering function S(Q, ω) takes a simple Lorentzian form S(Q, ω) varies as $(1/\kappa_1^2 + q^2) \cdot (\Gamma^2/ + \omega^2)$ with $\Gamma = \Lambda q^2$, where Λ is the diffusion constant and κ_1 the inverse correlation range. At T/sub c/, where $\Gamma = Aq^{2\ 5}$, this can be reduced to a universal scattering function $q^{0\ 5}/[q^5 + (\omega/A)^2]$. This scaling gives an entirely new and unified interpretation of magnetic scattering from Ni, Fe and all other isotropic cubic ferromagnets.

20434 **(CBPF-NF—018/82) Effective-field treatment of an anisotropic Ising ferromagnet: thermodynamical properties.** Sarmento, E.F.; Honmura, R.; Tsallis, C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701045.

The anisotropic square lattice spin -1/2 Ising ferromagnet is discussed. Through this system it is illustrated how all relevant thermodynamical quantities (phase diagram, magnetization, short range order parameter, specific heat and susceptibility) can be approximatively calculated within an effective-field unified procedure

(which substantially improves the Mean Field Approximation). Two slightly different approximations for the susceptibility (whose exact computation is still lacking) are presented. The (square lattice) - (linear chain) crossover is exhibited. The present (mathematically simple) procedures could be useful in the study of complex Ising problems.

20435 **(CBPF-NF—024/82) Quenched bond-dilute Ising ferromagnet in square lattice: thermodynamical properties.** Honmura, R.; Sarmento, E.F.; Tsallis, C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701046.

Within an effective field framework which improves the Molecular Field Approximation, the phase diagram, magnetization, specific heat and susceptibility associated with the quenched bond-dilute Ising ferromagnet in square lattice is calculated. The results are qualitatively (and within certain extent quantitatively) satisfactory; in particular the effects, on the specific heat and susceptibility, of the (eventually) coexisting finite and infinite clusters are exhibited.

20436 **(CONF-811113—58) Cu(100) multilayer relaxation.** Davis, H.L.; Noonan, J.R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007533.

From American Vacuum Society national symposium; Anaheim, CA, USA (3 Nov 1981).

To investigate whether multilayer relaxation could be demonstrated to exist in a relatively simple metallic surface, existing LEED data for Cu(100) have been reanalyzed. The results from the new analysis clearly provide evidence for multilayer relaxation in Cu(100), and the first and second interlayer spacing are indicated to deviate, respectively (-1.10 +- 0.40)% and (+1.70 +- 0.60)%, from the bulk value. Evidence is also found to suggest that the third interlayer spacing is expanded by more than 1%. The quoted values for the deviations of the first and second interlayer spacings are mean values which resulted from analyses of data for each of 16 individual I-V profiles, while the error limits were obtained for a 95% confidence level using a Student t statistics test. The above values were found also to be consistent with results obtained when different multi-beam R-factors were used to analyze averaged experimental I-V profiles.

20437 **(CONF-840269—1) In-situ measurements of bronze deterioration.** Youngdahl, C.A.; Kupperman, D.S.; Reimann, K.J. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007300.

From NAPAP Task Group G peer review meeting; Burlington, VT, USA (14 Feb 1984).

Bronze structures exposed out of doors suffer corrosion damage that is believed to be greatly accelerated by acid precipitation. The estimation of the rate of loss of valuable cultural resources composed of bronze and of the possible beneficial effects of mitigation of acid deposition is an important objective of Task Group G. To support a survey of representative populations of existing bronze structures, nondestructive instrumental methods are needed that are rapid as well as comprehensive. This task explores the applicability of ultrasonic and eddy current methods to such assessment.

20438 **(CONF-840555—2) Pyrochemical solvolysis of ore-bound transition metals.** Maroni, V.A.; Yonco, R.M. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 6p. NTIS PC A02/MF A01; GPO Dep. Order Number DE84003999.

From Spring meeting of the Electrochemical Society; Cincinnati, OH, USA (6 May 1984).

Considerable success has been achieved in lixiviating cobalt and manganese from domestic minerals using LiCl-KCl eutectic (60-40 mol %, mp ~ 350°C). In the case of oxidic cobalt-containing ores and $MnCO_3$-type ores, 90 to 100% of the cobalt or manganese is brought into solution, while most (~ 99%) of the iron remains in the undissolved residue. No transition metals are lixiviated from domestic cobalt-containing sulfide ores by LiCl-KCl unless (1) an acidic post transition metal halide (e.g., $BiCl_3$, $SnCl_2$, $ZnCl_2$, $HgCl_2$) is added to the eutectic/ore mixture or (2) the ore is air roasted prior to equilibration with the LiCl-KCl eutectic. Attempts to recover lixiviated cobalt from LiCl-KCl by electrodeposition on graphite have been successful.

20439 **(DOE/ER/03158—117) Chemistry on a subnanometer scale of radiation-induced precipitation and segregation in fast-neutron irradiated tungsten-rhenium alloys.** Herschitz, R.; Seidman, D.N. (Cornell Univ., Ithaca, NY (USA)). Feb 1984. Contract AC02-76ER03158. 10p. (CONF-840271—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009142.

From 2. Israel materials engineering conference; Beer-Sheva, Israel (22 Feb 1984).

W-10 at.% Re and W-25 at.% Re alloys were investigated, employing the atom-probe field-ion-microscope technique. The W-10 at.% Re is subsaturated with respect to the solvus line of the primary solid solution (β phase), while the W-25 at.% Re alloy is supersaturated with respect to the same solvus line. Results on EBR-2-irradiated specimens show a significant alteration of the microstructure. In the case of W-10 at.% Re, precipitates with the composition ~ WRe and a disc-shaped morphology were detected at a number density of ~ 10^{16} cm^{-3}, and a mean diameter of ~ 57 A. For W-25 at.% Re, precipitates with the composition ~ WRe_3 were detected; the precipitate's number density is ~ 10^{17} cm^{-3} with a mean diameter of 40 A. None of the ~ WRe precipitates or the ~ WRe_3 coherent precipitates were associated with either line or planar defects or with any impurity atoms, indicating a true homogeneous radiation-induced precipitation. The semicoherent WRe_3 precipitates were associated with ^4He atoms. In W-25 at.% Re, a two-dimensional WRe_3 phase has been observed at a grain boundary. An argument is presented for the nucleation of WRe or WRe_3 precipitates in the viciniity of the displacement cascades. It is suggested that in both cases the first step in the nucleation of a precipitate is due to the formation of tightly-bound mobile mixed dumbbells which react to form an immobile di-rhenium cluster. Possible sequences of point-defect reactions which can lead to either WRe or WRe_3 cluster are detailed. The further growth of a cluster (WRe or WRe_3) into a precipitate is most likely driven by the irreversible vacancy: self-interstitial atom annihilation reaction. Point-defect mechanisms for all the other observations are also discussed.

20440 **(DOE/ER/10972—T2) Influence of nitrogen on the sensitization, corrosion, mechanical, and microstructural properties of stainless steels. Second annual report.** Clark, W.A.T. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering). Apr 1983. Contract AC02-81ER10972. 72p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE83017203.

In order to elucidate the mechanistic role of nitrogen on the SCC of austenitic stainless steels in high temperature water, slow-strain-rate tests in 0.01M Na_2SO_4 and 0.01M NaCl aqueous solutions, at 250°C, and metallographic observations of the microstructure by TEM and SEM were carried out in the current study on austenitic stainless steels with various nitrogen contents.

20441 **(EUR—8639-EN/IT) Development of bainitic nodular iron for the construction of speed gears for the car industry. Final report.** Corso, S. (Fiat Auto Spa, Turin (Italy)). 1983. 32p. (In Italian). European Community Information Service, 2100 M St., NW, Washington, DC 20037.

Includes extensive English summary.

It is concluded that the characteristics of spheroidal cast iron, austempered and shot-peened, are inferior to those of case-hardened steel currently used for gear manufacturing. The machinability tests performed on a large lot of bevel gear pairs made from spheroidal cast iron have permitted one to quantify the savings obtainable in terms of tool costs, but at the same time they indicated the occurrence of critical deformation on the finished parts, which can be only partially eliminated with the straightening operation. For these reasons, the use of spheroidal cast iron in the field of gear manufacturing is possible provided that the necessary changes are made in the heat treatment and machining cycles. The work done, however, served to highlight a wide range of possible uses of

surface hardening cycles, that could be successfully employed for components requiring a high fatigue strength.

20442 **(FEI—1285) Corrosion-alkali cracking of materials for sodium-water steam generator.** Starkov, O.V.; Mukhin, I.P.; Zhelnin, V.D.; Mel'nichenko, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700738.

Analysis of Soviet and foreign investigations on alkali effect on corrosion cracking of low-alloyed, stainless steels and alloys with increased content of nickel at the temperature up to 371 deg C is carried out. Data on the effect of sodium medium, containing hydroxide, on characteristics of heat resistance and plasticity of steels 10Kh2M and 0Kh18N9 at 500 deg C are presented.

20443 **(IAE—3610/10) High temperature heat capacity of $Zr_{75}Rh_{25}$ superconducting system in amorphous, metastable and stable crystal state.** Panova, G.Kh.; Chernop'lekov, N.A.; Shikov, A.A.; Fogarashi, B.; Kemen', T.; Tsiraki, A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700739.

Heat capacity of the $Zr_{75}Rh_{25}$ superconducting system in amorphous, metastable and stable crystal states in the 100-700 K temperature range has been measured using a differential scanning calorimeter. The analysis of the results obtained has shown that density of electron state at the Fermi level increases during the process of amorphnous state formation, but a phonon spectrum, as a whole, becomes more rigid and an anharmonicity becomes stronger. In consequence, Tsub(c) increase during the process of amorphous state formation is mainly associated with the increase of etectron density of states the Fermi level.

20444 **(INIS-SU—197) Radiation damage physics and radiation technology.** (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 106p. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780108.

The papers presented were entered into the data base separately. (WHK)

20445 **(INR—483/2) Lattice dynamics of zinc.** Maliszewski, E.; Rosolowski, J.; Sledziewska, D.; Czachor, A. (Institute of Nuclear Research, Warsaw (Poland)). Dec 1963. 12p. NTIS (US Sales Only), PC A02. Order Number DE84900980.

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Phonon dispersion relations in zinc single crystals were measured in the directions [0001], [01anti10] and [1anti210] using the triple axis crystal spectrometer and the cold neutron time-of-flight methods. Theoretical expressions for these relations were calculated using the Born von Karman theory with two, three and four neighbour force interactions of central and general type. Comparison of the theoretical and experimental curves was done for central and general-type force interactions with first and second nearest neighbours, and for central forces up to third nearest neighbours. For the direction [0001] this comparison shows a good fit in shape and initial slopes. For the direction [01anti10] the longitudinal branches fit the shapes of the calculated curves. The optical and acoustical branches in the [01anti10] and [1anti210] directions with the polarization normal to the basal plane do not fit the theoretical curves in shape or in magnitude. A possible explanation of this discrepency is given.

20446 **(INR—510/14) Deformation of aluminium single and polycrystals on thermal cycling.** Seyna, F. (Institute of Nuclear Research, Warsaw (Poland)). Jul 1964. 16p. NTIS (US Sales Only), PC A02. Order Number DE84901024.

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Aluminium with a purity of 99.5 per cent, 99.85 per cent, 99.99 per cent was tested by different thermal loading. Continuous growth of aluminium single crystals and transformation into the polycrystalline structure was observed. The relationship between the deformation value and direction, and the main thermal loading parameters and the microstructure was found, and graphically presented for the polycrystalline aluminium. Appearance of recrystallization upon thermal cycling was observed.

20447 **(INR—524/16) Study on industrial rectification process of cadmium by means of radioactive tracers.** Akerman, K.; Brafman, M.; Fik, H.; Nowak, M.; Kruszewski, K. (Institute of Nuclear Research, Warsaw (Poland)). Mar 1964. 10p. (In Polish). NTIS (US Sales Only), PC A02. Order Number DE84901026.

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Methods of cadmium production and principles of a rectification technique used in Poland for rectifying cadmium materials obtained in zinc metallurgy have been reviewed. Studies on the separation of cadmium from zinc and on the behaviour of arsenic under normal, industrial conditions of cadmium rectification have been described. Experiments were performed on a plant with the aid of the following radioactive tracers: ^{115}Cd, /sup 69m/Zn, and ^{76}As. Results have confirmed the theoretical computation of rectification columns, carried out by Fik on the basis of Krupkowski's parallel current rectification theory and indicated the possibility of rectification of a cadmium charge, containing arsenic in spite of high volatility of the latter.

20448 **(INR—722/2/PL) Growing of large oriented aluminium single crystals with non-fused seed crystals.** Modrzejewski, A. (Institute of Nuclear Research, Warsaw (Poland)). 1960. 4p. NTIS (US Sales Only), PC A02. Order Number DE84901007.

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Large oriented single crystals of aluminium were grown by the modified Bridgman method. It has been found that the attaching (fusing) of the seed crystal to the main crystal was not necessary for obtaining single crystals of controlled orientation.

20449 **(ITEF—118(1982)) Cause of change in the rate of electric resistance increase with temperature in metals and alloys.** Gorshkov, V.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700740.

Using the samples of molybdenum and alloy W-20% Re it has been proved experimentally that in metals and alloys the change of the rate of temperature growth of electric resistance, when it is not due to the phase or other transformations in the basic structure of semiconductor, is conditioned by gradual increase of near surface layer thickness H with temperature increase T, the layer possessing different properties as to the bulk, i. e. by the process of gradual transformation of the sample structure into such a layer. Therefore the temperature range, in which the growth rate changes, depends on the sample thickness. Regularity of the growth of H(T) in metals and alloys is the same: the layer thickness increases with the temperature according to exponential curve and at high T it can reach millimeter value. The absolute value H is determined by physical properties of the conductor.

20450 **(ITEF—119(1982)) Interrelation between the rate of increase of electric conductivity with temperature and specimen thickness in metallic alloys.** Gorshkov, V.K.; Kalantarov, V.D.; L'vov, L.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700741.

Under conditions of normal external pressure the rate of electric resistance R growth of metal alloys depending on the temperature T in the range of above 20 deg C at different sample thickness (from 10 to 55 μm) has been studied. It is shown that there is the same effect in alloys which has been previously detect-

ed in metals: the change of resistance growth rate, if it is not conditioned by phase or other transformations in the basic structure of the alloy, is connected with the sample thickness. The temperature, corresponding to the change beginning and the temperature after which the change ends and linear dependence R(T) is established, increase considerably with the sample thickness increase. The investigation has been conducted using the alloys W-20% Re, brass L68, alumel.

20451 **(JAERI-M—82-196) Compatibility of heat resistant alloys with boron carbide, (2).** Baba, Shin-ichi; Nagamatuya, Takaaki; Aoyama, Isao; Ito, Hisanori; Muraoka, Susumu. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 34p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700742.

In the present design of the control rod for the experimental Very High Temperature Gas-cooled Reactor, sintered pellets of boron carbide mixed with graphite are used as a neutron absorber, which are clad with the sheath material of Hastelloy XR. The sintered pellet contains 30 wt% of natural boron. Chemical reaction occurs between the neutron absorber and the sheath material when they contact mutually at elevated temperature. The term called compatibility is defined as the ability of those materials to be used together without undesirable reaction, in this report. The experimental results on the compatibility of both materials are presented and are discussed on three subjects as (1) the comparison between Hastelloy X and Hastelloy XR, (2) the long term exposure, (3) the effect of the reaction barrier. No difference was observed between Hastelloy X and Hastelloy XR within the conditions of the experiment at 850°C, 950°C and 1050°C for each 100 h concerning the first subject. On the second, the penetration depth of 74 um and 156 um were observed on Hastelloy X reacted with sintered pellets (boron carbide and graphite) at 750°C for 3000 h and 850°C for 2000 h, respectively. On the third subject, Hastelloy X surfaces were coated with zirconia or alumina powder by plasma spraying process and by calorizing process in order to prevent the above mentioned reaction. These specimens were tested under two conditions: the one was a simple heat test of 1000°C - 100 h and the other was five thermal cycles of 1000°C - 20 h. The test results showed that no reaction occurred in the both alloys themselves and some of the coated layers were stripped or cracked.

20452 **(JAERI-M—83-021) Studies on fatigue crack growth around weldment in SUS304 stainless steel. Experimental results and FEM analyses on relaxation and redistribution of residual stress with crack growth.** Shibata, Katsuyuki; Kawamura, Takaichi; Yokoyama, Norio. (Japan Atomic Energy Research Inst., Tokyo). Feb 1983. 30p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700735.

Failures in a welded component are frequently found due to the factors induced by welding. One of such factor is the welding residual stress, and it may affect on the failures. Authors have performed a series of investigations to study the behavior of the welding residual stress during the crack extension. In this study, the influence of welding residual stress on the fatigue crack growth, and the relaxation and redistribution of the residual stresses with the crack extension have been investigated using the center cracked tension specimen of AISI Type304 stainless steel, which has relatively large amount of the residual stress by welding. FEM analyses has been performed on the behavior of the residual stress during the crack extension, and a simple analytical procedure to evaluate the fatigue crack growth in a residual stress field has also been developed. As a part of the above study, in this report are described the experimental results and FEM analyses on the relaxation and redistribution of residual stresses with the crack extension. It is found from the results that the relaxation of residual stresses is caused in the cracked region and the relaxed loads are redistributed forward with the extension of crack, and consequently, the residual stresses become larger than the initial value and positive even at the location where the initial residual stresses are negative. The redistribution of the residual stresses also causes plastic deformations around the cracked region.

20453 **(NIIAR—20(535)) Experience in the use of Zr+1%Nb alloy as the VK-50 Atomic Power Plant fuel element cladding.** Tsykanov, V.A.; Davydov, E.F.; Shamardin, V.K.; Andreeva, A.B.; Zabelin, A.I.; Eshcherkin, V.M.; Maershina, G.I.; Pokrovskij, A.S. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1982. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700749.

Investigation results into the fuel elements irradiated at the VK-50 atomic power plant are summarized. Considered are the general tendency in the Zr+1% Nb alloy behaviour under irradiation and the kinds and reasons for the fuel element failure. The effect of water chemistry conditions on the fuel element performance is demonstrated.

20454 **(ORNL/FMP—84/1) AR & TD Fossil Energy Materials Program. Quarterly progress report for the period ending December 31, 1983.** Bradley, R.A. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 504p. NTIS, PC A22/MF A-01; 1; GPO Dep. Order Number DE84009480.

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The objective of the AR & TD Fossil Energy Materials Program is to conduct reseach and development on materials for fossil energy applications with a focus on the longer-term and generic needs of the various fossil fuel technologies. The program includes research aimed toward a better understanding of materials behavior in fossil energy environments and the development of new materials capable of substantial enhancement of plant operations and reliability. The management of the Program has been decentralized to DOE Oak Ridge Operations Office (ORO) and the Oak Ridge National Laboratory (ORNL) as technical support contractor. The ORNL Fossil Energy Materials Program Office compiles and issues this combined quarterly progress report from camera-ready copies submitted by each of the participating subcontractor organizations. This report of activities on the program is organized in accordance with a work breakdown structure defined in the AR & TD Fossil Energy Materials Program Plan for FYs 1982 to 1986 in which projects are organized according to fossil energy technologies. We hope this series of AR & TD Fossil Energy Materials Program quarterly progress reports will aid in the dissemination of information developed on the program.

20455 **(RFP—3610) Computerized version of the summary of binary phase diagrams.** Selle, J.E. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 10 Mar 1984. Contract AC04-76DP03533. 237p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84009405.

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A number of years ago, in an attempt to simplify the process of presenting Binary phase diagram information, a wall chart Summary of Binary Phase Diagrams was developed. With this wall chart, one could rapidly search through the diagrams available for a given element and select only those diagrams displaying certain features. With the advent of computers and more specifically the desk top computer, conversion of the data on the wall chart to a computerized format has become practical. This conversion has now been accomplished, and the purpose of this report is to present the data in this format, describe the method used, and try to explain some uses of this type system.

20456 **(TIM—368) Test and metallographic examination of venturi specimen 109-Fa exposed to liquid metals at high temperature for 492 hours.** Herman, A.J. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 28 Dec 1956. Contract AC02-84PW02789. 2p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009912.

Paper copy only, copy does not permit microfiche production; Declassified 13 Apr 1960.

In order to study effects of high velocity liquid-metal on type 316 stainless steel surface under engine conditions of liquid-metal velocity, temperature and pressure, a high velocity venturi was designed, built, and tested in he High Pressure Radiator Components Test Stand. After 492 hours at 1500F with surface velocities of 46 to 60 feet per second, the venturi was examined by metal-

lographic methods and found to have sustained only minor damage to exposed surfaces.

20457 (UCRL—90466) Plating on some difficult-to-plate metals and alloys. Dini, J.W.; Johnson, H.R. (Lawrence Livermore National Lab., CA (USA); Sandia National Labs., Livermore, CA (USA)). 21 Feb 1984. Contract W-7405-ENG-48. 16p. (CONF-8405121—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008329.

From Symposium on difficult to plate materials; Ulm, F.R. Germany (3 May 1984).

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Electrodeposition of coatings on metals such as beryllium, beryllium-copper, Kovar, lead, magnesium, thorium, titanium, tungsten, uranium, zirconium, and their alloys can be problematic. This is due in most cases to a natural oxide surface film that readily reforms after being removed. The procedures we recommend for plating on these metals rely on replacing the oxide film with a displacement coating, or etching to allow mechanical keying between the substrate and plated deposit. The effectiveness of the procedures is demonstrated by interface bond strengths found in ring-shear and conical-head tensile tests. 3 figures, 9 tables.

20458 (Y/DU—336) Calculations of the reaction between uranium and water and comparison experimental observations. Condon, J.B.; Cristy, S.S.; Kirkpatrick, J.R. (Oak Ridge Y-12 Plant, TN (USA)). 16 Feb 1984. Contract W-7405-ENG-26. 10p. (CONF-840664—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007663.

From 9. international congress on metallic corrosion; Toronto, Canada (3 Jun 1984).

The reaction kinetics of uranium oxidation by either water or oxygen is controlled by an internal oxidation mechanism. Evidence for this is obtained by ion microprobe mass analysis (IMMA) depth profiling of samples exposed to isotopically labeled reactant gases. A model, which has wider application for other metal oxidations, containing no adjustable parameters has been formulated. This model correctly predicts both the reaction rates and the details of the IMMA depth profiles. The unique feature of the model is the inclusion of kinetics that have finite rate constants for the phase transformation. The model predicts, and the IMMA experiments demonstrate, that the poisoning of the water reaction is due to sub-metal surface competition of dissolved oxygen with the normally very damaging hydrogen.

20459 Measurement of electron loss rates in high-pressure mercury. Moody, S.E.; Center, R.E. (Mathematical Sciences Northwest, Inc., Bellevue, Washington 98004). *Journal of Applied Physics;* **55**: No. 7, 2721-2725(1 Apr 1984). Contract AC06-77DP40037.

The rates of electron decay in high-pressure mercury/helium discharges have been measured using a novel two-photon ionization technique. The rate coefficient of electron loss in this system was found to be well characterized by a two-body rate coefficient of k/sub d/ = 1.05(+- 0.25) x 10^{-8} cm^3 sec^{-1}, assuming dissociative electron-ion recombination. The electron temperature during these measurements is calculated to be 0.4(+- 0.1) eV. We also report a free-bound optical absorption coefficient at 222 nm of sigma-circumflex/sub A/ = (2.0 +- 0.5) x 10^{-39} cm^5.

20460 Effect of material strength on determining pressures "on" and "off" the Hugoniot. Moss, W.C. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Applied Physics;* **55**: No. 7, 2741-2746(1 Apr 1984). Contract W-7405-ENG-48.

It has been traditional to use the fluid approximation when using solid Hugoniot data to construct a constitutive equation for the pressure as a function of volume and energy. The tradition rests on the assumption that material strength is negligible at large pressures, and the unavailability of Hugoniot shear stress data. However, material strength may be non-negligible, even at large Hugoniot stresses, and a method for calculating shear stresses along the Hugoniot has been developed, so that in principle, P(V,E) can be constructed without making the fluid approximation. Using beryllium as an example, we show how to construct P(V,E), taking material strength into account. We also show that the calculated shear stresses along the Hugoniot are less than the actual values, due to assumptions that are made to reduce the data. Thus, the resulting ratios of the Hugoniot shear stress to the Hugoniot pressure underestimate the actual values. In beryllium, this ratio varies from 0.07 at 5 GPa to 0.015 at 35 GPa.

20461 Spin correlations near the ferromagnetic-to-spin-glass crossover (invited). Aeppli, G.; Shapiro, S.M.; Maletta, H.; Birgeneau, R.J.; Chen, H.S. (AT & T Bell Laboratories, Murray Hill, New Jersey 07974). *Journal of Applied Physics;* **55**: No. 6, 1628-1633(20 Mar 1984). Contract AC02-76CH00016.

We have performed neutron scattering studies on two very different alloys which undergo transitions from ferromagnetic (FM) to spin-glass (SG) states as the temperature is reduced. The alloys are Eu/sub x/Sr/sub 1-x/S, a crystalline insulator, and (Fe/sub x/Mn/sub 1-x/)$_{75}P_{16}B_6Al_3$, an amorphous metal, and their FM-SG multicritical points are at $x \simeq 0.50$, T = 4 K and $x \simeq 0.65$, T = 42 K respectively. In spite of the substantial differences between these materials, the neutron scattering data show that their spin correlations are remarkably similar. In particular, for the samples near the multicritical points, a single Lorentzian describes the magnetic scattering very well. Its width κ corresponds to a ferromagnetic correlation length ξ which, as T is reduced, first increases to a value indistinguishable from infinity, and then decreases to a finite value, as expected for a ferromagnet which evolves into a reentrant spin glass. As the Fe or Eu content is raised, the scattering function at low temperatures deviates increasingly from the Lorentzian form, and is better described by a power law Q/sup -alpha/ with $2<\alpha<3$. We find no evidence for coexistence of ferromagnetic order with freezing of the transverse spin components, as proposed by Gabay and Toulouse. We argue on general grounds that the zero-field Gabay-Toulouse state cannot exist in real magnets. However, our results can be explained in terms of the random field effects which arise when ferromagnetic and spin-glass order parameters are coupled together.

20462 Effects of neutron irradiation on magnetic permeability of amorphous and crystalline magnetic alloys. Brown, R.D.; Cost, J.R.; Stanley, J.T. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **55**: No. 6, 1754-1756(20 Mar 1984).

In order to compare the radiation resistance of amorphous and crystalline magnetic alloys, samples of commercial high-permeability alloys were irradiated with high-energy neutrons near the beam stop of LAMPF. Both crystalline and amorphous alloys showed a decrease of permeability with increasing fluence. Samples prepared from Permalloy (crystalline) and the amorphous alloys Metglas 2605S-3 and 2705M were tested. The permeability of the Metglas 2605S-3 sample showed the slowest rate of decrease, being at least a factor of ten slower than for the Permalloy. The permeability decrease as a function of fluence for Metglas 2605S-3 appears to occur in two stages. It is proposed that the first stage is due to directional short-range ordering that occurs at an enhanced rate due to the excess point defects produced by the irradiation. The second stage is thought to be caused by pinning of domain walls by defect clusters produced by the collision cascade.

20463 Moessbauer spectroscopy study of amorphous $Fe_{87}B_{11}Au_2$ ribbon and its crystallization products. Lin, M.C.; Barnes, R.G. (Ames Laboratory, USDOE, and Department of Physics, Iowa State University, Ames, Iowa 50011). *Journal of Applied Physics;* **55**: No. 6, 1826-1828(20 Mar 1984). Contract W-7405-ENG-82.

Substantial increases in Fe saturation magnetization have been obtained in amorphous Fe—B containing small concentrations of gold. This material is also stable above 300 K, and thus has considerable practical significance. We report the results of an investigation of amorphous $Fe_{87}B_{11}Au_2$ ribbon and its crystallization products based on ^{57}Fe Moessbauer spectroscopy. The amorphous ribbon exhibits a broad magnetic hyperfine splitting pattern typical of a metallic glass with an effective hyperfine field, H/sub eff/ = 257 kOe, and an isomer shift of 0.058 mm/s relative to metallic Fe at 300 K. The spectra of samples annealed for 25 min between T/sub A/ = 618 and 708 K arise from a metastable amorphous phase

of Fe—Au—B and a crystalline α-Fe phase. H/sub eff/ of the metastable amorphous phase decreases with respect to increased annealing temperature. However, H/sub eff/ of the α-Fe phase increases from 331 kOe for samples annealed at 618 K to 334 kOe for those annealed at 708 K. This increase can be attributed to an increased content of Au in the α-Fe phase. Annealing the samples at temperatures above 753 K for 25 min yields crystalline α-Fe and the intermetallic compound Fe_3B.

20464 **Temperature dependence of the field-induced magnetic form factor of the intermetallic compound $PrSn_3$.** Loong, C.; Stassis, C.; Zarestky, J.; McMasters, O.D.; Moon, R.M. (Intense Pulsed Neutron Source Program, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Applied Physics;* **55**: No. 6, 1838-1840(20 Mar 1984). Contract W-7405-ENG-26.

The spatial distribution of the magnetization induced by a magnetic field of 42.5 kG in a single crystal of $PrSn_3$ has been studied at 100 and 20 K using polarized neutron scattering techniques. We find that at both temperatures the measured form factor is in good agreement with the theoretical 4f magnetic form factor of the Pr^{3+} ion. This result is in contrast to the large deviations from the 4f magnetic form factor of Ce^{3+} observed, at low temperatures, for the mixed-valence compounds $CeSn_3$ and $CePd_3$. The localized static susceptibility of $PrSn_3$ at 100 and 20 K, obtained by extrapolating the measured form factor to the forward direction, agrees very well with bulk susceptibility measurements.

20465 **Orientation of Gd moments in RE/sub x/Gd/sub 1-x/Rh_4B_4 (RE = Ho, Er).** Noakes, D.R.; Umarji, A.M.; Shenoy, G.K.; Hinks, D.G. (Materials Science and Technology Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Applied Physics;* **55**: No. 6, 1847-1849(20 Mar 1984).

The orientation of the Gd magnetic moment with respect to the crystallographic axes in the magnetically ordered states of $GdRh_4B_4$ and RE/sub x/Gd/sub 1-x/Rh_4B_4 (RE = Ho and Er) materials has been studied with the ^{155}Gd Moessbauer effect. Rare-earth single-ion anisotropies induced by the crystalline electric field (CEF) force the Gd moment to point in particular directions. These directions depend on which rare earth has been substituted into the lattice and will be discussed in terms of a CEF model for these materials. The results demonstrate that the ^{155}Gd Moessbauer effect can be used as a probe of magnetic ordering directions in rare-earth materials.

20466 **Dynamics of itinerant ferromagnets above T/sub C/ (invited).** Shirane, G.; Steinsvoll, O.; Uemura, Y.J.; Wicksted, J. (Brookhaven National Laboratory, Upton, New York 11973). *Journal of Applied Physics;* **55**: No. 6, 1887-1892(20 Mar 1984). Contract AC02-76CH00016.

A review is given of our current studies of the magnetic scattering, above T/sub C/, from Ni, Fe, and Fe (4%-Si). Reliable scattering functions S(Q,ω) are obtained up to 50 meV of energy transfer by combining polarized and unpolarized neutron techniques. Although constant E scans show magnon like peaks in agreement with the previous Oak Ridge data, no peaks are observed in our constant Q scans up to 0.5 A^{-1}, in contrast to the well defined peak reported by Lynn for Fe(12%-Si). Unexpectedly, for a wide temperature range, the scattering function S(Q,ω) takes a simple Lorentzian form S(Q,ω)proportional$(1/\kappa^2_1+q^2)$ x $(\Gamma/\Gamma^2+\omega^2)$, with $\Gamma = Aq^2$, where A is the diffusion constant, and κ_1 the inverse correlation range. At T/sub C/, where $\Gamma = Aq$/sup 2.5//, this can be reduced to a universal scattering function q/sup 0.5// $[q^5+(\omega/A)^2]$. This scaling gives an entirely new and unified interpretation of magnetic scattering from Ni, Fe, and all other isotropic cubic ferromagnets.

20467 **Investigation of the paramagnetic phase of bcc iron using polarized neutron scattering.** Wicksted, J.P.; Shirane, G.; Steinsvoll, O. (Brookhaven National Laboratory, Upton, New York 11973). *Journal of Applied Physics;* **55**: No. 6, 1893-1894(20 Mar 1984). Contract AC02-76CH00016.

Recent neutron scattering experiments performed at Brookhaven on Ni and Fe (4% Si) above T/sub C/ have demonstrated that a simple paramagnetic scattering function S(Q,ω)proportional$[1/(\kappa^2_1+q^2)]$ x $[\Gamma/(\Gamma^2+\omega^2)]$ can explain the persistent spin wave ridges previously reported by Lynn and Mook. We present our new polarized beam results on pure Fe and describe in some detail the special problems associated with the unpolarized beam studies of magnetic cross sections at high temperatures.

20468 **Site occupation of ternary elements in $Sm_2(CoTM)_{17}$ compounds.** Krishnan, K.M.; Rabenberg, L.; Mishra, R.K.; Thomas, G. (Materials and Molecular Research Division and the National Center for Electron Microscopy, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **55**: No. 6, 2058-2060(20 Mar 1984).

The crystallographic positions of Fe and Mn atoms in a Sm_2 (CoFe Mn)$_{17}$ permanent magnet have been investigated using electron channeling/blocking techniques. Using the tilting and diffraction capabilities of an analytical transmission electron microscope, an electron beam was made to propagate along specific crystallographic directions in the magnet. By monitoring the characteristic x-ray spectrum as a function of incident electron beam orientation, it was possible to determine that 88.5% of the Mn and 85.1% of the Fe atoms occupy sites in the mixed planes in this compound.

20469 **Moessbauer spectroscopy and scanning electron microscopy study of iron-graphimet.** Lin, M.C.; Barnes, R.G. (Ames Laboratory, USDOE, and Department of Physics, Iowa State University, Ames, Iowa 50011). *Journal of Applied Physics;* **55**: No. 6, 2294-2296(20 Mar 1984). Contract W-7405-ENG-82.

^{57}Fe Moessbauer effect spectroscopy (ME), electron spin resonance (ESR), and computer-controlled scanning electron microscopy (CCSEM) have been used to investigate samples of commercial iron-graphimet (reduced iron-chloride intercalated graphite), which is of interest because of its role in the methanization of carbon. The CCSEM results indicate that most of the inorganic particles ranging in size between 0.2 and 40 μm are mixtures of iron chlorides giving average x-ray fluorescence spectra of Fe and Cl in the approximate ratio 1 : 2. At 300 K the ME spectrum consists of three broad lines of unequal intensity plus the usual six-line pattern of metallic iron. A complex pattern gradually develops out of two of the broad lines with decreasing temperature below 77 K. From the hyperfine field obtained at 13 K and the ESR spectrum, this phase has been identified as ultrafine nonstoichiometric iron oxide, magnetite (Fe_3O_4). The broad, asymmetric quadrupole doublet in the 13-K spectrum has the isomer shift and quadrupole splitting typical of high-spin Fe^{2+}. These values are close to those of anhydrous $FeCl_3$ and $FeCl_3$-intercalated graphite. During measurements at 800 K in vacuum ($\sim 10^{-5}$ Torr), the oxide particles partially agglomerate through sintering, and the normal ME spectrum of Fe_3O_4 is observed.

20470 **Crystal fields and second-order magnetic hyperfine interactions in $TmFe_2Si_2$.** Umarji, A.M.; Shenoy, G.K.; Noakes, D.R.; Dattagupta, S. (Materials Science and Technology Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Applied Physics;* **55**: No. 6, 2297-2299(20 Mar 1984).

We report the measurement of Moessbauer hyperfine spectra of $TmFe_2Si_2$ using the 8.4 keV transition in ^{169}Tm. The detailed temperature dependence of the quadrupole interaction has permitted us to evaluate the crystalline electric fields (CEF) acting on Tm atom. The analysis indicates the ground state of Tm to be a singlet state. However, the hyperfine coupling of the ^{169}Tm with the excited CEF states generates a second order magnetic hyperfine interaction which has been observed in our experiment. An account of the spin relaxation of the second-order magnetic hyperfine interaction is presented.

20471 **Low hysteresis materials for magnetic refrigeration: Gd/sub 1-x/Er/sub x/Al_2.** Zimm, C.B.; Barclay, J.A.; Johanson, W.R. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **55**: No. 6, 2609-2610(20 Mar 1984). Contract W-7405-ENG-36.

The series of ferromagnetic intermetallics Gd/sub 1-x/ Er/sub x/Al_2 are candidate working materials for magnetic refrigeration because of their large moment, small anisotropy, and their wide range of Curie temperatures (14 to 164 K). We have measured the magnitude of the magnetic hysteresis as a function of temperature from 4 K to T/sub C/ for polycrystalline samples of these materials by ac magnetic susceptibility and magnetization hysteresis loops. We found, as expected, virtually no hysteresis in $GdAl_2$, and, more surprisingly, less than 3000 A/m hysteresis in $ErAl_2$ and 2 x 10^4 A/m in Gd/sub 0.5/ Er/sub 0.5/Al_2. Moreover, the hysteresis in Gd/sub 0.5/ Er/sub 0.5/Al_2 was $<$100 A/m for T-T/sub C/$<$ 20 K.

20472 Electron beam cutting in amorphous alumina sheets. Mochel, M.E.; Eades, J.A.; Metzger, M.; Meyer, J.I.; Mochel, J.M. (Department of Metallurgy and Mining, Department of Physics and Materials Research Laboratory, University of Illinois at Urbana—Champaign, Urbana, Illinois 61801). *Applied Physics Letters;* **44**: No. 5, 502-504(1 Mar 1984). Contract AC02-76ER01198.

We have found that nanometer diameter holes and slots can be cut in thin sheets of amorphous alumina using an intense electron beam. The holes, formed by a nonthermal process, are uniform in diameter, are surrounded by metallic aluminum, and can penetrate a 100-nm sheet in a few seconds. The amorphous alumina sheets are formed by anodization of electropolished high purity aluminum. The electron beam cutting seems very similar to the process reported in the metal β-aluminas. Since uniform, stable, and easily handled sheets of amorphous alumina can be fabricated and electron beam cut, this process is now practical for nanolithography as well as many other applications.

20473 Microstructure-independent acoustoelastic measurement of stress. Thompson, R.B.; Smith, J.F.; Lee, S.S. (Ames Laboratory, USDOE, Iowa State University, Ames, Iowa 50011). *Applied Physics Letters;* **44**: No. 3, 296-298(1 Feb 1984). Contract W-7405-ENG-82.

Measurements are reported of the velocities of horizontally polarized shear waves (fundamental mode) propagating in the plane of aluminum plates under tensile loads applied parallel to the rolling direction. In agreement with the predictions of previous theories, the applied stress is found to be predicted by the expression $2C(\Delta V/V)$, where C is the appropriate second-order shear elastic constant and $\Delta V/V$ is the fractional difference in velocities of waves propagating parallel and perpendicular to the load. The data show that, whereas the individual velocities are strongly influenced by microstructure, the stress prediction based on their difference is not. Included are results illustrating the effects of preferred grain orientation and plastic deformation.

20474 Low-temperature ultrasonic study of trapped hydrogen in niobium. Poker, D.B.; Setser, G.G.; Granato, A.V.; Birnbaum, H.K. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review [Section] B: Condensed Matter;* **29**: No. 2, 622-629(15 Jan 1984). Contract AC02-76ER01198.

The elastic constants and attenuation of niobium containing low concentrations of oxygen and hydrogen (deuterium) have been measured between 0.5 and 15 K, as a function of temperature, frequency, polarization, and hydrogen isotope. Two relaxations were observed for the C′ mode. No observable relaxations appeared in C_{44} or the bulk modulus. At 10 MHz the relaxations occurred at 2.5 and 5.5 K for H, shifting to higher temperature for D. The relaxation strength of the low-temperature process is linear in H concentration, while the higher-temperature process is nonlinear. The low-temperature process exhibits an apparent activation energy of 1.8 meV, with a nonclassical temperature dependence of the relaxation strength. The constraints which these results place upon a delocalized-wave model are discussed.

20475 ^{13}C nuclear magnetic resonance in bis-tetramethyltetraselenafulvalenium hexafluorophosphide $(TMTSF)_2PF_6$ under pressure. Azevedo, L.J.; Schirber, J.E.; Engler, E.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] B: Condensed Matter;* **29**: No. 1, 464-465(1 Jan 1984). Contract AC04-76DP00789.

The nuclear spin-lattice relaxation rate, T_1^{-1}, of enriched ^{13}C nuclei in $(TMTSF)_2PF_6$ is measured in the high-pressure metallic phase at low temperature and high magnetic fields. T_1^{-1} is found to depend logarithmically on applied field. These results are interpreted as nuclear relaxation to a charge carrier diffusing in two dimensions and are shown to be consistent with measurements on other nuclei in the material. By comparison with earlier measurements on ^{77}Se it is concluded that the spin-density-wave state interacts weakly with the carbon sites in the crystal.

20476 LEED and AES study of structural and chemisorptive properties of Zr overlayers on the Pt(100) crystal face. Bardi, U.; Ross, P.N.; Somorjai, G.A. (Lawrence Berkeley Laboratory, Materials and Molecular Research Division and Department of Chemistry, University of California, Berkeley, Berkeley, California 94720). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **2**: No. 1, 40-49(Jan 1984). Contract AC03-76SF00098.

Zirconium overlayers were deposited onto a Pt(100) surface by electron beam evaporation in UHV, and the composition and structure of the surface was determined by AES and LEED. The overlayers were highly reactive towards oxygen, carbon monoxide, and hydrocarbons, forming oxide or carbide overlayers. Several metastable ordered structures were observed by LEED when oxidized overlayers were thermally annealed in UHV. Protracted annealing at $>$900 K results in reduction and dissolution of the oxidized overlayer with complete disappearance of zirconium from the surface. Oxygen dosing of annealed surfaces at 25 °C caused resegregation of zirconium to the surface, and the formation of an ordered PtZr/sub x/O/sub y/ surface phase which may be a zirconia analog to the yttria ternary oxide PtYO/sub 3.5/. This phase was stable in oxygen at 25—300 °C, but oxygen dosing at above 300 °C resulted in precipitation of ZrO_2 islands on top of the Pt(100)-(1 x 1) substrate.

20477 New transient electrical polarization phenomenon in sawtooth superlattices. Capasso, F.; Luryi, S.; Tsang, W.T.; Bethea, C.G.; Levine, B.F. (AT & T Bell Laboratories, Murray Hill, New Jersey 07974). *Physical Review Letters;* **51**: No. 25, 2318-2321(19 Dec 1983). Contract AC02-76CH00016.

Theory and experimental evidence of a new transient polarization phenomenon, unique to sawtooth superlattices, are presented. This effect is the consequence of the lack of reflection symmetry in these structures and can be used for the implementation of a new class of high-speed, displacement current photodetectors.

20478 New explanation of the spin-wave-like excitations in Ni above T/sub c/. Uemura, Y.J.; Shirane, G.; Steinsvoll, O.; Wicksted, J. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **51**: No. 25, 2322-2325(19 Dec 1983). Contract AC02-76CH00016.

A simple paramagnetic scattering function for neutrons, with Lorentzian shapes both in energy and in momentum transfer, is demonstrated to give a full explanation of the spin-wave-like peaks observed in Ni at and above T/sub c/ in constant-energy scans of thermal neutron scattering. A model calculation for Ni confirms the direct connection to the critical scattering, and a comparison with EuO reveals that the spectral shape is governed by the spin-diffusion and spin-wave—stiffness constants.

20479 Absence of itinerant-electron ferromagnetism in $LaRh_6B_4$. Schilling, J.S.; Shelton, R.N.; Klavins, P.; Shaheen, S.A. (Ames Laboratory, U.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **28**: No. 11, 6548-6549(1 Dec 1983). Contract W-7405-ENG-82.

Contrary to previous studies which reported itinerant-electron ferromagnetism for $LaRh_6B_4$ at 6 K, no evidence for ferromagnetism is found for high-purity $LaRh_6B_4$ in the ac susceptibility down to 40 mK and the static magnetization down to 3 K. It would seem probable that the "ferromagnetism" reported previously for this compound was not intrinsic but arose from too high a concentration of magnetic impurities. Similar studies on $CeRh_6B_4$,

YRh_6B_4, and $LuRh_6B_4$ fail to find any evidence for either ferromagnetism or superconductivity above 40 mK.

20480 Quantitative study of vacancy defects in quenched tungsten by combined field-ion microscopy and electrical resistometry. Park, J.Y.; Siegel, R.W. (Argonne National Lab., IL (USA)), Huang, H.C.W. (IBM Components Div., Hopewell Junction, NY (USA)); Balluffi, R.W. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). *Philosophical Magazine, [Part] A: Defects and Mechanical Properties;* **48**: No. 3, 397-419(Sep 1983).

A study of quenched, high-purity tungsten has been carried out with a combination of field-ion microscopy (FIM) and electrical resistivity measurements. It is concluded that the quenched-in vacancy defects observed by FIM are monovacancies and nearest-neighbour divacancies. From the partitioning during quenching between these two species, a divacancy binding enthalpy Hsub(2v)sup(b) approx.= 0.7 eV is deduced. A monovacancy resistivity of 7 x 10^{-4} Ω cm is obtained from the combined measurements. The quenched-in vacancy concentrations measured directly by FIM are consistent with previous results, if the total vacancy concentration at the melting temperature of tungsten (3695 K) is about 3 x 10^{-4} and the monovacancy formation enthalpy and entropy are 3.6 eV and 3.2k, respectively. The results are discussed in terms of the atomic-defect mechanisms for self-diffusion in tungsten.

20481 Experimental determination of the energy dependence of defect production. Merkle, K.L.; King, W.E. (Argonne National Lab., IL (USA)); Baily, A.C.; Haga, K.; Meshii, M. (Northwestern Univ., Evanston, IL (USA)). *Journal of Nuclear Materials;* **117**: 4-11(Jul 1983). (CONF-821049—).

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

A knowledge of primary damage production as a function of recoil energy is essential for predicting defect production in radiation environments of practical interest. The damage function $\nu(T)$, i.e., the number of Frenkel pairs as a function of recoil energy, is determined for Cu from electron and ion damage-rate measurements. $\nu(T)$ shows a plateau at $\nu = 0.54$ which extends up to approx.= 7Tsub(d)sup(min). Therefore, simple damage models, such as the modified Kinchin-Pease expression, are strongly deficient, not only at high recoil energies where stimulated recombination in cascades reduces defect production, but also in the single displacement regime. As a consequence, no simple relation between Tsub(d)sup(min) and Tsub(d)sup(av) is expected to exist. A procedure is suggested which uses anisotropy measurements in combination with polycrystal electron and ion irradiations to construct absolute damage functions in metals.

20482 Defect production in simulated cascades: Cascade quenching and short-term annealing. Heinisch, H.L. (Hanford Engineering Development Lab., Richland, WA (USA)). *Journal of Nuclear Materials;* **117**: 46-54(Jul 1983). (CONF-821049—). Contract AC06-70FF02170.

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

Also published as report HEDL-SA-2692-FP.

Defect production in displacement cascades in copper has been modeled using the MARLOWE code to generate cascades and the stochastic annealing code ALSOME to simulate cascade quenching and short-term annealing of isolated cascades. Quenching is accomplished by using exaggerated values for defect mobilities and for critical reaction distances in ALSOME for a very short time. The quenched cascades are then short-term annealed with normal parameter values. The quenching parameter values were empirically determined by comparison with results of resistivity measurements. Throughout the collisional, quenching and short-term annealing phases of cascade development, the high energy cascades continue to behave as a collection of independent lower energy lobes. For recoils above about 30 keV the total number of defects and the numbers of free defects scale with the damage energy. As the energy decreases from 30 keV, defect production varies with the changing nature of the cascade configuration, resulting in more defects per unit damage energy. The simulated annealing of a low fluence of interacting cascades revealed an interstitial shielding effect on depleted zones during Stage I recovery.

20483 Theory of helium transport and clustering in materials under irradiation. Ghoniem, N.M.; Sharafat, S. (California Univ., Los Angeles (USA). School of Engineering and Applied Science); Williams, J.M. (Oak Ridge National Lab., TN (USA). Solid State Div.); Mansur, L.K. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.). *Journal of Nuclear Materials;* **117**: 96-105(Jul 1983). (CONF-821049—). Contract W-7405-ENG-26.

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

A theoretical model is developed to describe helium transport and clustering during irradiation. Diffusional reactions of helium with vacancies and vacancy clusters, with extended sinks for helium absorption, and direct reactions with displacement producing particles are included. The full description developed is employed in numerical computations. A simpler description is also developed in the limits where certain reactions are unimportant. Analytical expressions for the effective diffusion coefficient of helium are derived. Regimes of the parameter space of dose rate, temeprature, helium generation rate, sink strength and other important conditions, where the effective diffusion coefficient is dictated by three different physical processes, are defined. The result is determined by the dominant release mechanism of helium bound in vacancies-thermal detrapping, replacement by the self-interstitial or direct displacement. Results from the full computations and the analytical expressions are compared.

20484 Theory of pulsed irradiation microstructures. Simonen, E.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Journal of Nuclear Materials;* **117**: 113-117(Jul 1983). (CONF-821049—12).

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

Also published as report, Oct 1982.

Flux pulsing is predicted to influence microstructures because of pulse annealing effects on aggregate annealing and on point defect annealing. Specifically void annealing and vacancy annealing are analyzed. A high dislocation density enhances the void annealing effect but inhibits the point defect annealing effect. Furthermore, pulsing effects are greater for higher damage rates and smaller defect aggregates. It is concluded that pulsed ion irradiations can simulate pulsed fusion irradiations if it is recognized that the ions exaggregate the expected neutron effect.

20485 Resistance of 9 Cr-1 MoVNb and 12 Cr-1 MoVW steels to helium embrittlement. Klueh, R.L.; Vitek, J.M. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.). *Journal of Nuclear Materials;* **117**: 295-302(Jul 1983). (CONF-821049—). Contract W-7405-ENG-26.

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

Small amounts of helium (15-40 at. ppm) are known to cause embrittlement in a large number of alloys when tensile tested at elevated temperatures. To determine the effect of helium on ferritic steels of interest for fusion reactor applications, tensile specimens of normalized-and-tempered 9 Cr-1 MoVNb with 0.1 and 2% Ni and 12 Cr-1 MoVW with 0.4, 1, and 2% Ni were irradiated in the High Flux Isotope Reactor (HFIR) at approx.= 55°C. Helium up to approx.= 42 at. ppm was produced by a two-step reaction of ^{58}Ni with thermal neutrons. No embrittlement was detected in tensile tests at 700°C. These results are contrasted with the more severe embrittlement reported in the literature for several other types of alloys containing 15-30 at. ppm He.

20486 (RFP-Trans—424) Electrochemical refining of manganese in chloride melts. Safonov, V.V.; Mikhina, V.N.; Vorob'eva, A.S.; Korshunov, V.G.; Suchkov, A.B. Translated from *Izvestiya Vysshikh Uchebnykh Zavedenii, Tsvetnaya Metallurgiya ;* No. 2, 57-60(1968). Contract AC04-76DP03533. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009460. DE84009460

Thermal analysis has been used to study the interaction of manganese chloride (II) with chlorides of sodium and potassium in

melts. A phase diagram of the $MnCl_2$-NaCl-KCl system has been constructed, and the range of compositions that can be used as electrolyte in the electrorefining of manganese and its alloys has been set. Experiments have been conducted in the electrorefining of manganese. The conditions for obtaining cathodic metal of varied fineness have been set forth.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 19726, 19728, 19729, 20119, 20119, 20353, 20451, 21553, 21597

20487 **(CONF-8404106—2) Rationalizing the hydrogen sites in Pd$_3$P/sub 1-x/H/sub y/.** Westlake, D.G. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009159.

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

A recently developed geometric model has been used to rationalize the observed site occupation by hydrogen atoms in hydrogenated Pd_3P/sub 1-x/. While several types of interstices appear to be large enough to accommodate hydrogen atoms, only one type that is associated with a vacant phosphorous site is actually occupied. A repulsive interaction between hydrogen and phosphorous atoms has been invoked to explain this behavior. Consideration of probabilities has shown that the applicability of a blocking model without any overlap of H-H interactions should be attributed to the wide separation of P sites that is inherent in the structure of Pd_3P.

20488 (HEDL—7437, pp 9p, Paper 2) **Thermal properties of Li_8ZrO_6.** Hollenberg, G.W.; Baker, D.E. 1984. NTIS, PC A03/MF A01.

In Contribution to 6th annual report on special purpose materials for magnetically confined fusion reactors: solid breeder materials.

The thermal expansion, specific heat and thermal conductivity of Li_8ZrO_6 were measured. A phase transformation was detected at 659°C in Li_8ZrO_6 by both specific heat and thermal expansion measurements.

20489 **Effects of superconductivity on rare-earth ion dynamics in (Ho/sub x/Lu/sub 1-x/)Rh_4B_4.** Heffner, R.H.; Cooke, D.W.; Hutson, R.L.; Leon, M.; Schillaci, M.E.; Smith, J.L.; Yaouanc, A.; Dodds, S.A.; Gupta, L.C.; MacLaughlin, D.E. . (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **55**: No. 6, 2007-2009(20 Mar 1984).

Zero-field muon spin-lattice relaxation rates have been measured in magnetically diluted Ho/sub x/Lu/sub 1-x/Rh_4B_4 ternary compounds, primarily for x = 0.02. For temperatures below ~11 K a characteristic two-component structure of the muon depolarization function is observed, which is consistent with slow (quasistatic) Ho^{3+}-moment fluctuations. We have reported similar behavior for x = 0.7, which indicates that the slow fluctuations are due to crystal-field isolation of the Ho^{3+} ground state. The observed relaxation rates in this temperature regime depend little on x, which is consistent with conduction-electron (Korringa) exchange scattering as the dominant mechanism for the fluctuations. The observed temperature dependence of muon spin-lattice relaxation in the superconducting state is not presently understood.

20490 **Evaluation of the statistical distribution of fracture strength: Discussion of some recent contributions.** Rosenfield, A.R.; Shetty, D.K.; Duckworth, W.H. (Battelle-Columbus, Columbus, Ohio 43201). *Journal of Applied Physics;* **55**: No. 4, 1206-1207(15 Feb 1984). Contract W-7405-ENG-92.

Several recent statistical analyses of ceramic strength have concentrated on the form of the distribution function associated with a set of uniform specimens. It is pointed out that prediction of the effect of specimen size is an integral part of current statistical strength theory, and can be used to discriminate among alternative distribution functions.

20491 **Optical properties of tantalum carbide from the infrared to the near ultraviolet.** Modine, F.A.; Major, R.W.; Haywood, T.W.; Gruzalski, G.R.; Smith, D.Y. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review [Section] B: Condensed Matter;* **29**: No. 2, 836-841(15 Jan 1984). Contract W-7405-ENG-26.

Optical properties of a nearly stoichiometric single crystal of tantalum carbide are reported. Specular reflectance was measured between 0.03 and 6.0 eV, and ellipsometry measurements were made between 1.2 and 4.6 eV. The ellipsometry results were used to fix the value of the phase obtained from a Kramers-Kronig analysis of the reflectance over a finite energy interval, and optical functions were computed between 0 and 6 eV. The optical conductivity at zero photon energy agrees well with the electrical conductivity obtained from resistivity measurements made by the van der Pauw method. Intraband contributions to the optical properties are assessed in terms of both one-carrier and two-carrier models. Broad structure near 5 eV is interpreted as due to interband transitions between states near the square face of the Brillouin zone.

20492 **Orthorhombic uranium(IV) molybdenum(VI) oxide, UMo_2O_8.** Cremers, T.L.; Eller, P.G.; Penneman, R.A.; Herrick, C.C. (Los Alamos National Lab., NM (USA)). *Acta Crystallographica, Section C: Crystal Structure Communications;* **39**: No. 9, 1163-1165(15 Sep 1983).

Msub(r) = 557.8, orthorhombic, Pban, a = 20.076(4), b = 7.323(1), c = 4.1164(6) A, V = 605.2 A^3, Z = 4, Dsub(m) = 6.08(6), Dsub(x) = 6.12 Mg m^{-3} Mo Kα, lambda = 0.70930 A, μ = 367 cm^{-1}, F(000) = 960, T = 298 K, R = 0.049 for 1347 reflections. The structure consists of layers of oxide-bridged uranium and molybdenum atoms connected by infinite interlayer U-O-U and Mo-O-Mo chains. The uranium atoms have pentagonal bipyramidal coordination [U-O equatorial = 2.202(6)-2.394(8) A, U-O axial = 2.0584(3) A]; the molybdenum atoms are in a highly distorted octahedral [Mo-O = 1.684(7)-2.432(7) A] arrangement. The presence of oxide ions not connected to molybdenum suggests that this structure is better formulated as a double oxide-molybdate than as a true molybdate.

20493 **Orthorhombic thorium(IV) molybdate, $Th(MoO_4)_2$.** Cremers, T.L.; Eller, P.G.; Penneman, R.A. (Los Alamos National Lab., NM (USA)). *Acta Crystallographica, Section C: Crystal Structure Communications;* **39**: No. 9, 1165-1167(15 Sep 1983).

Msub(r) = 551.9, orthorhombic, Pbca, a = 10.318(5), b = 9.737(4), c = 14.475(6) A, V = 1454 A^3, Z = 8, Dsub(x) = 5.04 Mg m^{-3}, Mo Kα, lambda = 0.70930 A, μ = 244 cm^{-1}, F(000) = 1904, T = 298 K, R = 0.038 for 3167 unique reflections. The structure is that of a true molybdate, with nearly regular molybdate tetrahedra bridging to thorium coordinated in a nearly regular square antiprismatic environment. The structure determination generally confirms but markedly improves a rough structure previously reported.

20494 **Electronic structure of CeO_2 and PrO_2.** Koelling, D.D. (Argonne National Lab., IL (USA)); Boring, A.M.; Wood, J.H. (Los Alamos National Lab., NM (USA)). *Solid State Communications;* **47**: No. 4, 227-232(Jul 1983).

The electronic structure of CeO_2 and PrO_2 was determined by performing SCF band calculations. It is found that in both systems there are metal f- and d- electrons in the oxygen 2p bands. The question of valency and ionicity in these systems are discussed.

20495 **(ORNL-tr—5071) Single crystal growth of LaB_6 and other metal borides.** Tanaka, T.; Bannai, E.; Kawai, S. Translated from *Seramikkusu ;* **11**: No. 12, 1083-1092(1976). Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006620. DE84006620

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In the past three years, the authors have been studying the subject of the single crystal growth of LaB_6 and have finally succeeded in growing high purity single crystals by repeating zone refinement under a pressurized atmosphere by a floating zone method. Studies are now under way on the physical characteristics

of SmB_6, CrB_2, and ZrB_2 by growing their single crystals employing the above method.

3603 Composite Materials

REFER ALSO TO CITATION(S) 19739

20496 **(HEDL—7372) RTNS-II irradiation of ceramic insulated instrument components in support of FMIT test-end design.** Cannon, C.P. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-70FF02170. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009501.

Irradiations were conducted on ceramic-to-metal seals and thermoelement wire types in May 1983, to create a technical basis from which to design instrument components for the Fusion Materials Irradiation Test (FMIT) test-end region. Five ceramic-to-metal seal types were irradiated to a fluence of 2 x 10^{18} n/cm^2 in RTNS-II. One seal type lost hermeticity at that fluence; the other four types, including the type installed in the FMIT accelerator stage constructed at Los Alamos, remained hermetic to 10^{-9} cc He/s. Results to date suggest that a tensile bond configuration will not remain hermetic in a 14 MeV neutron fluence. Postirradiation evaluation of this experiment is still in progress. The FMIT accelerator will require ceramic-to-metal seals that remain hermetic in the 14 MeV fusion neutron fluence to 10^{21} n/cm^2. There is no practical way to conduct prototypic irradiation evaluations to that fluence. The intent of the present effort is to establish a technical basis for seal design from lower fluence 14 MeV data and high fluence fast fission neutron data.

20497 **Displacement cascades in polyatomic materials.** Parkin, D.M.; Coulter, C.A. (Los Alamos National Lab., NM (USA)). *Journal of Nuclear Materials;* **117**: 340-344(Jul 1983). (CONF-821049—).

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

Also published as report LA-UR--82-3126; CONF-821049--1.

Using a continuous slowing-down, random amorphous material model, we have studied displacement cascades in a number of diatomic materials. This paper reviews a number of previously obtained results that elucidate the effect of atomic mass, recoil energy, displacement energy, capture energy, and material stoichiometry on the numbers of displacements in a cascade. The displacement cascade reveals a complex structure that is dependent on the type of irradiation and the material properties. Conclusions related to damage analysis for fusion reactors are given.

20498 **(ORNL-tr—5082) Mechanical properties of silicon nitride ceramic composite reinforced with silicon carbide whiskers.** Ueno, K.; Toibana, Y. Translated from *Yogyo Kyokai Shi ;* **91**: No. 11, 491-497(1983). Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006968. DE84006968

A ceramic composite of silicon nitride reinforced with silicon carbide whiskers was fabricated by hot-pressing at 1800°C under 34.3 to 39.2 MPa and its mechanical properties were evaluated. Two-dimensional alignment of the whiskers perpendicular to the pressing direction was facilitated in the sintering process. The composite had a bending strength of 590 to 680 MPa at a room temperature up to 1300°C, showing that it was degraded only a little at 1300°C. The addition of the whiskers over 40 wt % made it difficult to densify the composite, resulting in a decreased porosity of over 10%, which, nevertheless, did not cause a decrease in the strength of the composite. This suggests that the addition of the whiskers introduces the controlled defects finely in the composite, to prevent the stress concentration and make the composite insensitive to the inner defects or cracks. Statistical analysis gave a Weibull's modulus of 25 for the room temperature strength of the composite, which indicates that the mechanical reliability of the composite was much higher than that of ordinary Si_3N_4 ceramic.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 20164, 20695

20499 **(SAND—83-1854C) Accelerated-aging methods as selection bases.** Bonzon, L.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 10p. (CONF-840516—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006485.

From International symposium on aging in tests of safety equipment for nuclear power plants; Paris, France (15 May 1984).

There are real and substantial technical complexities in the application of accelerated-aging methods to determine a meaningful qualified life for safety-related materials and equipment. But, unfortunately, the debate over these complexities has dominated most thinking to the point of nearly excluding from consideration the most (potentially) valuable aspect of acceleration methods: their use as selection bases to obtain the best equipment and materials. We will demonstrate how the data (including extensive thermal and radiation data collected at Sandia), can be used in such a selection process, how ignoring the existing data can lead to inferior choices, and suggest ways to collect, take, and summarize data to be useful and available to the ultimate user, the utility.

20500 **(SAND—83-2017C) Model for combined radiation-temperature accelerated aging of PVC and polyethylene in air.** Gillen, K.T.; Clough, R.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-840516—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006723.

From International symposium on aging in tests of safety equipment for nuclear power plants; Paris, France (15 May 1984).

In order to extrapolate material accelerated aging data, models must be developed based on sufficient understanding of the processes leading to material degradation. A model is proposed to explain the extremely complex degradation behaviors of PVC and polyethylene materials in combined radiation/temperature/air aging environments. The model is based on simple chemical kinetic assumptions. Using a time, temperature, radiation dose rate shift procedure, we will show that accelerated aging data for the PVC and polyethylene materials are consistent with the model and that model extrapolations are in excellent agreement with 12-year real-time aging results from actual nuclear plant electrical cable.

20501 **(SAND—83-2019C) U.S.-French Cooperative Research Program: U.S. test results for cable insulation and jacket materials at the completion of accelerated aging.** Bustard, L.D. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-840516—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006713.

From International symposium on aging in tests of safety equipment for nuclear power plants; Paris, France (15 May 1984).

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Eight different U.S. insulation and jacket products have been accelerated aged at Sandia. The experimental variables included: (1) sequential versus simultaneous accelerated aging exposures; (2) the order of the sequential exposures; and (3) ambient versus 70°C irradiation temperatures during sequential aging exposures. We observed that the irradiation temperature (70°C or ambient) was secondary in importance to the choice of sequence for thermal and radiation aging. For most materials studied (except TEFZEL) the irradiation then thermal aging sequence was as severe or more severe than the thermal then irradiation aging sequence.

20502 **(SAND—83-2085C) Inadequacy of margin in qualification tests.** Clough, R.L.; Gillen, K.T. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-840516—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006966.

From International symposium on aging in tests of safety equipment for nuclear power plants; Paris, France (15 May 1984).

Dose-rate effects are now widely known. One nuclear industry response is to use a large margin (i.e., over-dose) in qualification tests to account for this. We have carried out investigations of

polymer radiation degradation behaviors which have brought to light a number of reasons why this concept of margin can break down. First of all, we have found that dose-rate effects vary greatly in magnitude. Thus, based on high dose-rate testing, poor materials with large dose-rate effects may be selected over better materials with small effects. Also, in certain cases, material properties have been found to level out (as with PVC) or reverse trend (as with buna-n) at high doses, so that margin may be ineffective, misleading, or counterproductive. For Viton, the material properties were found to change in opposite directions at high and low dose rates, making margin inappropriate. The underlying problem with the concept of margin is that differences in aging conditions can lead to fundamental differences in degradation mechanisms.

3606 Other Materials

REFER ALSO TO CITATION(S) 19906, 19915, 20444, 20461, 20684, 21210

20503 (AD-A—134837/4) Electrode noise in beta aluminas. Interim technical report. Brophy, J.J.; Smith, S.W. (Utah Univ., Salt Lake City (USA). Dept. of Physics). Nov 1983. 25p. (TR—2). NTIS, PC A02/MF A01.

Conductivity fluctuations in the fast ionic conductors sodium and silver Beta alumina ceramic have been observed for the first time in research supported under Contract No. N00014-82-K-0603. The phenomena is not masked by contact noise effects and, indeed, contact current noise itself yields useful experimental data. Noise spectra suggesting relaxation and diffusion processes are found both in the bulk and at the electrodes. This proposal describes a continuation of the research effort which enables a more quantitative interpretation of experimental results in terms of transport properties of the model ions. The approach includes study of single crystal samples, as well as extension of these new experimental techniques to other fast ionic conductors such as silver iodide and conducting polymers. One phase of the proposed effort concentrates on the study of molten sodium electrodes to sodium Beta alumina ceramics under destructive breakdown conditions.

20504 (AERE-TP—991) Shrinkage of voids in electron irradiation of thin foils. Murphy, S.M.; Scotti, A.; Diana, E. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). May 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700745.

During experiments in the Harwell High Voltage Electron Microscope, voids close to the surface of the irradiated foils have been observed to shrink rapidly. It has been suggested that such shrinkage is caused by the preferential absorption of interstitials at the void surface relative to the surface of the foil, and this report describes calculations which support this view.

20505 (BNL—34251) Spin correlations near the ferromagnetic to spin glass crossover. Aeppli, G.; Shapiro, S.M.; Maletta, H.; Birgeneau, R.J.; Chen, H.S. (Bell Labs., Murray Hill, NJ (USA); Brookhaven National Lab., Upton, NY (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1984. Contract AC02-76CH00016. 24p. (CONF-831187—18). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007385.

From 29. annual conference on magnetics and magnetic materials; Pittsburgh, PA, USA (8 Nov 1983).

We have performed neutron scattering studies of two very different alloys which undergo transitions from ferromagnetic-like (FM) to spin-glass (SG) states as the temperature is reduced. The alloys are Eu/sub x/Sr/sub 1-x/S, a crystalline insulator, and (Fe/sub 1-y/Mn/sub y/)$_{75}P_{16}B_6Al_3$, an amorphous metal, and their FM-SG multicritical points are at $x \simeq 0.50$, T=4K and $y \simeq 0.35$, T=42K respectively. In spite of the substantial differences between these materials, the neutron scattering data show that their spin correlations are remarkably similar. In particular, for the samples near the multicritical points, a single Lorentzian describes the magnetic scattering very well. Its width κ corresponds to a ferromagnetic correlation length ξ which, as T is reduced, first increases to a value indistinguishable from infinity, and then decreases to a finite value, as expected for a ferromagnet which evolves into a re-entrant spin glass. As the Fe or Eu content is raised, the scattering function at low temperatures deviates increasingly from the Lorentzian form, and is better described by a power law Q/sup $-\alpha$/ with $2<\alpha<3$. We find no evidence for coexistence of ferromagnetic order with freezing of the transverse spin components, as proposed by Gabay and Toulouse. We argue on general grounds that the zero-field Gabay-Toulouse state cannot exist in real magnets. However, our results can be explained in terms of the random fields which arise when ferromagnetic and spin-glass order parameters are coupled together.

20506 (CONF-840269—4) Monitoring of mechanical properties, chemistry, and material loss of stone surfaces. Youngdahl, C.A.; Kupperman, D.S.; Reimann, K.J. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007298.

From NAPAP Task Group G peer review meeting; Burlington, VT, USA (14 Feb 1984).

As part of its effort on the effects of acid rain and weathering on fabricated materials, NADAP Task Group G is preparing to begin a field program in which masonry samples are exposed at several existing stations. It is planned to correlate the data on ambient conditions with the results of periodic measurements of damage to the masonry samples, and to distinguish the effects of acid deposition by analyzing the results obtained under differing sets of environmental conditions. In support of the field program, the subject task concerns the development of methods to assess damage experienced by the masonry specimens. In particular, the work explores (1) the use of ultrasonic surface waves to measure changes in surface mechanical properties and (2) methods of evaluating spurious effects on weight change measurements. The latter subtask includes the establishment of surface chemical analysis techniques, drying parameters, and method of measuring residual moisture.

20507 (CTA-EAV—009/81) Study of the photoacoustic effect in semiconductors. Effect of an DC-electric field. Bandeira, I.N.; Ghizoni, C.C.; Closs, H. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Atividades Espaciais). Jul 1981. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701037.

The photoacustic spectroscopy of semiconductors is considered through a phenomenological approach, emphasizing carrier diffusion effects, enhanced by an applied electric field. Experimental results support the proposed model, and lead to the determination of various important semiconductor parameters.

20508 (DOE/ER/10896—T1) Thermal expansion effects in cordierite. Final report, March 16, 1981-March 15, 1984. Predecki, P.K.; Fitzpatrick, J.J. (Denver Univ., CO (USA)). Feb 1984. Contract AC02-81ER10896. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007406.

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A Huber-Guinier x-ray diffraction system was modified for accurate expansion work. Lattice thermal expansion data were obtained on cordierite samples doped with Li^{+1}, Be^{+2}, B^{+3}, P^{+5}, Ca^{+2}, Zn^{+2}, Ge^{+4} at the 1% and 5% level. The a-axis thermal expansion was mostly linear with temperature and relatively insensitive to dopant type and level. The c-axis thermal expansion showed marked nonlinearities and trend reversals with temperature and dopant level. No obvious correlations were found between the expansion data and either ion size charge or the room temperature lattice parameters. The largest decrease in overall c-axis thermal expansion was shown by Li^{+1} at the 5% level and the largest initial decrease in c-axis expansion by Ca^{+2} at the 1% level.

20509 (DOE/ER/10978—4) CO_2 laser heating of silicon and applications. Kwok, H.S. (State Univ. of New York, Buffalo (USA). Dept. of Electrical and Computer Engineering). 1983. Contract AC02-81ER10978. 8p. (CONF-830425—37). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008273.

From Society of Photo-Optical Instrumentation Engineers conference; Santa Fe, NM, USA (11 Apr 1983).

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Pulsed CO_2 laser interaction with doped silicon can produce significant heating of the semiconductor. This heating is studied and two major applications are explored. Fast CO_2 laser detection due to the rapid thermal generation of carriers is demonstrated.

20510 **(IFUSP-P—334) Precision interplanar spacings measurements of boron doped silicon.** Soares, D.A.W.; Pimentel, C.A.F. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1982. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701040.

A study of lattice parameters of boron doped silicon (10^{14}-10^{19} atom/cc) grown in <111> and <001> directions by Czochralski technique has been undertaken. Interplanar spacings (d) were measured by pseudo-Kossel technique to a precision up to 0,001%; different procedures to obtain d and the errors are discussed. It is concluded that the crystallographic planes contract preferentially and the usual study of parameter variation must be made as a function of d. The diffused B particularly contracts the [333] plane and in a more pronunciate way in high concentrations. An orientation dependence of the diffusion during growth was observed.

20511 **(IFUSP-P—339) Irrational twins in α-$NiSO_4.6H_2O$ crystals.** Stojanoff, V.; Pimentel, C.A.F. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jun 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701041.

α - $NiSO_4$ $6H_2O$ crystals were grown from a monocrystalline seed in a saturated solution. X-ray studies has revealed the presence of twins. A possible origin for this twinning is discussed.

20512 **(IFUSP-P—355) Point defect aggregates in boron doped dislocation-free Czochralski silicon crystals.** Pimentel, C.A.F.; Brito Filho, C. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1982. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701047.

Bragg line profile (BLP) and high-resolution diffuse X-ray scattering (DXS) measurements have been obtained in boron Czochralski Si single crystals. The crystals, dislocation free, doped with B concentration (C sub(B) from 10^{14} to 10^{19} cm^{-3}, have been analysed in a double crystal diffractometer using a highly collimated $CuK\alpha_1$ radiation. Th BLP evidenced that the (111) plane is the most affected by doping process and in a more critical way for C sub(B) >= 10^{18} cm^{-3}. DXS results have shown the presence of clusters with typical size parameters of some tens to some thousands of angstrons with a prevaling interstitial-nature for the larger and vacancy-nature for the smaller, except for C sub(B) approximately 10^{19} cm^{-3} which presents only an interstitial-nature.

20513 **(INR—513/2) Preparation of compensated silicon samples with high concentration of impurities.** Jurkowski, J.; Nazarewicz, W. (Institute of Nuclear Research, Warsaw (Poland)). Feb 1964. 6p. NTIS (US Sales Only), PC A02. Order Number DE84901027.

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The compensation technique of silicon crystals with high impurity concentration ($10^{19}cm^{-3}$) by diffusion of lithium to the sample containing acceptor impurity atoms is described.

20514 **(JAERI-M—82-206) Irradiation-induced property changes of graphite/carbon matrices for fuel compact.** Kikuchi, Teruo; Tobita, Tsutomu; Ikawa, Katsuichi; Iwamoto, Kazumi. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 76p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700748.

Data are presented on irradiation-induced property changes of graphite/carbon matrices of fuel compact for HTGR. Irradiation data on needle coke graphite and gilsonite coke graphite are also presented for reference. Grapite/carbon matrices surveyed are needle coke graphite, milled isotropic graphite, petroleum coke graphite and natural graphite-petroleum coke graphite/carbon matrices. The contents of phenol resin binder are 10, 16 and 20 wt.%. These matrices are warm pressed and heat treated to 1800°C or 2400°C. These specimens are irradiated up to a fast neutron fluence of 2.3 x 10^{21} (n cm^{-2}) (E > 0.18 MeV) at a temperature range of 700 to 1100°C. Graphite/carbon matrix specimens showed greater shrinkage than graphite specimens and the maximum fractional dimensional change of the matrices is -2.0% at a neutron fluence of 2.3 x 10^{21} (n cm^{-2}). Correlation between property change and the origin of graphite powder are not clear, but the matrix specimens of 20% binder showed greater shrinkage than those of 10% binder and the specimens heat treated at 1800°C showed greater shrinkage than those at 2400°C. Young's modulus and electric resistivity are increased with fast neutron fluence and their fractional changes are 80 to 160% and 10 to 20% respectively at the fast neutron fluence of 2.3 x 10^{21} (n cm^{-2}).

20515 **(KURRI-TR—217) Report of the study meeting on physics and chemistry of organo polymer semiconductors.** Shirakawa, H.; Sakai, H.; Matsuyama, T. (eds.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1982. 73p. (In Japanese). (CONF-811294—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780100.

From Meeting on physics and chemistry of organo polymer semiconductors; Kumatori, Osaka, Japan (18 Dec 1981).

Abstracts of individual items from the meeting were prepared separately for the data base. (GHT)

20516 **(LBL—17320) Heatpulse annealing of ion-implanted silicon: structural characterization by transmission electron microscopy.** Sadana, D.K.; Shatas, S.C.; Gat, A. (Lawrence Berkeley Lab., CA (USA); AG Associates, Palo Alto, CA (USA)). Apr 1983. Contract AC03-76SF00098. 8p. (CONF-8303121—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009244.

From Microscopy of semiconducting materials meeting; Oxford, UK (21 Mar 1983).

A detailed structural investigation of Heatpulse rapid thermal annealed ion-implanted Si was carried out using TEM. Defect-free material was obtained after an 1100°C/10 s anneal for 80 keV 2 x 10^{15} ^{75}As implanted Si, while dislocation loops were still present after lower temperature anneals. When compared with arsenic, 35 keV ^{11}B implanted Si in the dose range 5 x 10^{14} exhibited markedly different behavior under the same annealing conditions, in that residual defects in the form of line dislocations, loops, and rods were observed. Comparison with 1000°C/30 min. furnace annealed samples showed differences in defect structures and impurity redistribution behavior as revealed by SIMS measurements. A model explaining the annealing behavior of implanted layers in silicon under rapid annealing conditions is proposed.

20517 **(SAND—83-1724) Quantitative analysis of phosphosilicate glass films: Sandia segment of round robin study.** Weissman, S.H. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1984. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010083.

Following our previous work on the analysis of phosphosilicate glass films and preparation of calibration standards, we were asked by Division 2141 to participate in an interlaboratory study to develop thin film calibration standards for use by the microcircuits industry. Sandia, Rockwell, Signetics, Balazs Laboratories and Kevex are the initial participants in this study; Bell Labs, Western Electric, NBS, Lawrence Livermore National Laboratory and Intel have also expressed interest in joining the study. We analyzed two sets of 4-inch silicon wafers, which were coated with phosphosilicate glass film using an atmospheric chemical vapor deposition (CVD) process. These samples were analyzed by chemically dissolving the film and determining the P and Si content of the resultant solution using inductively coupled plasma (ICP) atomic emission spectroscopy. As part of the experimental work, we conducted a complete analysis of all errors in the measurement process. The average weight percent phosphorus (+- 1 standard deviation) was 3.78 +- 0.15 for set 1 and 10.3 +- 0.73 for set 2. The average relative error was 6.32% and 5.54% for sets 1 and 2, respectively.

20518 **(SRD-R—249) Guide to the effects of nuclear irradiation on materials, electronic and electrical components, oils and greases.** Lewis, R.C.E. (UKAEA Safety and Reliability Directorate, Culcheth). Mar 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700750.

A review is given of the effects of radiation on a selection of materials. Potentially damaging radiation thresholds are listed. The information has been taken from 12 documents for which references are given. The results of a study comparing component fault rates for nuclear and non-nuclear chemical plant are presented.

20519 **(UFRJ-IF—07/83) Fluorescence of Cr^{3+} in ordered and disordered $LiAl_5O_8$ and in $LiGa_5O_8$.** Abritta, T.; Maria Neto, J.; Souza Barros, F. de; Melamed, N.T. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701042.

The spectra of Cr^{3+} in ordered and disordered $LiAl_5O_8$ and $LiGa_5O8$ are fairly complex, consisting of a strong zero phonon line with weaker lines on both high and low energy sides of the main line. The origins of the most most prominent lines in $LiAl_5O_8:Cr^{3+}$ are identified and it is show that a number of them are zero phonon lines, probably due to Cr^{3+} in sites having octahedral coordination with differing distortions, and that even in the ordered phase of this compound it has local domains characteristic of the disordered phase. It is also show that the previously reported R line splitting, with an abnormal value of 266 cm^{-1}, consists in fact of two separate Cr^{3+} centers in $LiAl_5O_8$, compled through phonon-assisted energy transfer. The large R-line splitting observed in $LiGa_5O_8:Cr^{3+}$, 278 cm^{-1} in magnitude, may also be due to the presence of two independent centers.

20520 **(UFRJ-IF—08/83) Fe^{3+} concentration effects in th: luminescence of LiAl sub(5-x)Fe sub(x) O_8 some experimental results.** Abritta, T.; Maria Neto, J.; Barthem, R.B.; Amorim, H.S. de; Souza Barros, F. de; Melamed, N.T. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701043.

Experimental data on concentrations effects in the luminescence of $LiAl_5O_8:Fe^{3+}$ are presented, and the formation of exchange-coupled ion pairs, the energy transfer and the process of luminescence extinction are discussed. The properties of a high energy fluorescent band are also presented.

20521 **(UFRJ-IF—10/83) ESR studies of electron irradiated $K_3Ir(CN)_6$ in KCl single crystals. Mono and di-chlorinated species.** Vugman, N.V.; Pinhal, N.M. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701044.

ESR studies of KCl single crystals doped with small amounts of $K_3Ir(CN)_6$ and submitted to a prolongued 2 MeV electron irradiation at room temperature reveal the presence of the $[IR(CN)_5Cl]^{4-}$ and $[Ir(CN)_4Cl_2]^{4-}$ new molecular species. Ligand spin densities and ligand field parameters are calculated from the experimental hyperfine and superhyperfine interactions and compared to previous data on the $[Ir(CN)_6]^{4-}$ species.

20522 (ZfI-Mitt—69, pp 368-376) **Radiation modified materials in mechanical engineering.** Zahalka, J. (Inst. for Research, Production and Applications of Radionuclides, Prague (Czechoslovakia). Radiation Chemistry of Radioisotopes). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The mechanical properties of machine parts made of polycaprolactam (polyamide 6) have been improved by ^{60}Co gamma irradiation with total doses of 1.7 to 2.0 x 10^5 Gy. Further, abrasives bonded with inorganic or organic materials have been subjected to ^{60}Co gamma radiation. A prolonged service life was observed. The reasons for this effect remained partly unclear. Cost benefit analysis has been carried out for both radiation applications.

20523 (ZfI-Mitt—69, pp 391-394) **Radiation modification of timber in people's Republic of Bulgaria.** Nikolov, S.; Panayotov, P.; Diakova, V.; Nikolova, M. Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Radiation-chemical modification of timber improves the mechanical quality and the biological stability. Timber of beech, poplar, alder, fir, oak, and pine trees is soaked with polymer-forming compounds as vinylacetate, methylmethacrylate, styrene, acrylonitrile or monomer mixtures and then irradiated by ^{60}Co γ-rays. The total conversion of the monomer soaked in timber depends mainly on the chemical nature of the modificator and the integral irradiation dose. Data on static hardness, pressure strength, impact strength, static bending strength, and humidity of modified timber are given.

20524 (ZfI-Mitt—69, pp 204-214) **Investigation of moisture migration in the concrete of a special test construction under simulated load conditions.** Baumbach, H. (Technische Hochschule, Leipzig (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The water migration in the concrete of steel member composite construction has been investigated under simulated load conditions using tritium as a tracer. Labelling, sampling, and sample preparation are described in detail. An unequal distribution of the tritium activity in the concrete adjoining the liner was found. The results obtained prove that the water vapor is mainly transported by the air flow through the voids and cracks in concrete and through existing fissures between concrete and outside liner.

20525 **Properties of amorphous hydrogenated silicon-tin alloys prepared by radio frequency sputtering.** Williamson, D.L.; Kerns, R.C.; Deb, S.K. (Physics Department, Colorado School of Mines, Golden, Colorado 80401). *Journal of Applied Physics;* **55**: No. 8, 2816-2824(15 Apr 1984). Contract AC02-77CH00178.

Amorphous Si/sub 1-x/Sn/sub x/ and Si/sub 1-x/Sn/sub x/:H (0< or =x< or =0.3) alloy films have been prepared by radio frequency sputtering from composite Si—Sn targets in Ar or Ar-10% H_2 mixtures at dynamic pressures of 4 or 20 mTorr. The structural characteristics of the alloys have been probed with ^{119}Sn conversion electron Moessbauer spectroscopy, x-ray diffraction, and infrared absorption. Most of the tin goes into tetrahedral substitutional Si sites at 4 mTorr whereas significant fractions of crystalline β-Sn are produced at 20 mTorr. The substitutional Sn Moessbauer resonance is systematically characterized with a Lorentzian doublet line shape. Oxygen contamination increases with increasing Sn content in the 20-mTorr films but is attributed to postdeposition oxidation. No evidence is found for Sn—H bonds or interstitial (nonbonded) Sn. The optical band-gap decreases at a rate of -0.056 eV/at. % Sn for alloys containing little or no β-Sn and for x up to 0.13. Both the optical band gap and the Moessbauer isomer shift extrapolate to α-Sn (grey tin) behavior at x≅0.3—0.4. The electrical conductivity increases with x at a rate which is not consistent with the measured reduction in band gap and a fixed relative Fermi level. This and the temperature dependence of the conductivity suggest a transition from extended state free-carrier conduction to localized state hopping conduction.

20526 **Grain-size effects on electrical properties of n-type polycrystalline chemical vapor deposition Si films.** Yang, J.J.; Simpson, W.I.; Manasevit, H.M.; Ruth, R.P. (Rockwell International, Microelectronics Research and Development Center, Anaheim, California 92803). *Journal of Applied Physics;* **55**: No. 8, 2995-2999(15 Apr 1984). Contract AC03-79ET23045.

The electrical properties of phosphorus-doped n-type polycrystalline Si films deposited by chemical vapor deposition were investigated as a function of both impurity concentration and average grain sizes in the films. Sets of simultaneously grown films with average grains ranging from <1 to >100 μm have been deposited on polished selected polycrystalline high-purity alumina substrates. The impurity concentrations were in the range 10^{15}—10^{18} cm^{-3}. The transport properties of the n-type polycrystalline films have been determined by Hall-effect measurements as a function of sample temperature in the range 77—420 °K using the van der Pauw technique. The experimental results are interpreted in terms of a grain-boundary model.

20527 Fluorescence line narrowing in neodymium laser glasses. Hall, D.W.; Weber, M.J.; Brundage, R.T. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Journal of Applied Physics;* **55**: No. 7, 2642-2647(1 Apr 1984). Contract W-7405-ENG-48.

Polarized and time-resolved resonant laser-excited fluorescence spectra were recorded for the $^4F_3/sub\ //_2 \rightarrow {}^4I_{11}/sub\ //_2$ transition of Nd^{3+} in several commercial silicate and phosphate glasses. Excitation sources were pulsed Nd:$LiYF_4$ (1053 nm) and Nd:$Y_3Al_5O_{12}$ (1064 nm) lasers. Measurements of line-narrowed spectra yield linewidths ranging from 35 to 64 +- 10 cm^{-1}, depolarization ratios from 0.81 to 0.93, and spectral energy transfer rates $<$ or $\approx 3 \times 10^3\ s^{-1}$ for Nd^{3+} concentrations $<$ or $\approx 2 \times 10^{20}\ cm^{-3}$. The variations of these properties with wavelength and glass composition are discussed. Hole burning and gain saturation of glass laser amplifiers due to spectral and polarization inhomogeneities can be predicted from these results.

20528 Deuterium in germanium: Interaction with point defects. Pearton, S.J.; Kahn, J.M.; Hansen, W.L.; Haller, E.E. (Lawrence Berkeley Laboratory and University of California, Berkeley, California 94720). *Journal of Applied Physics;* **55**: No. 6, 1464-1471(15 Mar 1984). Contract AC03-76SF00098.

Electrical measurements on deuterium plasma-treated germanium samples containing deep level recombination centers show significant neutralization of these defects to depths of ~80 μm. Chemical measurement of the deuterium profile after similar plasma treatment shows apparent incorporation depths of ~0.2 μm. We discuss experiments which resolve this discrepancy, and show that hydrogen diffusion into the bulk of the germanium is responsible for the observed neutralization.

20529 Spatially resolved measurement of substitutional dopant concentrations in semiconductors. Pennycook, S.J.; Narayan, J.; Holland, O.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Applied Physics Letters;* **44**: No. 5, 547-549(1 Mar 1984). Contract W-7405-ENG-26.

It is shown that a simple ratio technique based on the electron channeling phenomenon can be used to measure substitutional fractions of dopants in submicron-sized regions of semiconductors. Samples were made from $^{121}Sb^+$ implanted Si, solid-phase-epitaxially regrown, and analyzed by ion channeling. One sample was sequentially annealed so as to precipitate out various fractions of the dopant in excess of the solubility limit. In the fully annealed sample electron channeling measurements could quantitatively determine the fraction of Sb in precipitate form since it was randomly located with respect to the matrix. In the partially annealed sample electron channeling indicated a larger nonsubstitutional fraction than could be accounted for by observed precipitates.

20530 Point defect trapping in solid-phase epitaxially grown silicon-antimony alloys. Pennycook, S.J.; Narayan, J.; Holland, O.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Journal of Applied Physics;* **55**: No. 4, 837-840(15 Feb 1984). Contract W-7405-ENG-26.

Supersaturated silicon alloys produced by antimony implantation followed by solid-phase-epitaxial growth (furnace annealing), contain a supersaturation of interstitials. This is deduced from the observation of a transient, greatly enhanced diffusion of Sb into precipitates upon heating, accompanied by the formation of interstitial loops. In similar alloys produced by liquid-phase-epitaxial regrowth (pulsed laser annealing) much lower diffusion coefficients were obtained and no loops were observed. These observations provide clear evidence for the diffusion of the substitutional Sb dopant by an interstitialcy mechanism. The activation energy of the enhanced diffusion was 1.8 +- 0.2 eV, presumably corresponding to the migration enthalpy of Sb by the interstitialcy mechanism. The loop number density at the end of the transient gave an estimate of the initial interstitial concentration, which allowed the diffusivity of Sb by the interstitialcy mechanism to be estimated.

20531 Fluctuations in Schottky barrier heights. Mahan, G.D. (Corporate Research and Development, General Electric Company, Schenectady, New York 12301). *Journal of Applied Physics;* **55**: No. 4, 980-983(15 Feb 1984). Contract W-7405-ENG-26.

A double Schottky barrier is often formed at the grain boundary in polycrystalline semiconductors. The barrier height is shown to fluctuate in value due to the random nature of the impurity positions. The magnitude of the fluctuations is 0.1 eV, and the fluctuations cause the barrier height measured by capacitance to differ from the one measured by electrical conductivity.

20532 Excimer laser annealing of ion-implanted silicon. Narayan, J.; Holland, O.W.; White, C.W.; Young, R.T. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Applied Physics;* **55**: No. 4, 1125-1130(15 Feb 1984). Contract W-7405-ENG-26.

We have studied pulsed excimer laser (xenon chloride, wavelength 0.308 μm) annealing of boron, arsenic, and self-ion-implanted silicon specimens that contained dislocation loops and/or amorphous layers. Microstructural changes as a function of laser parameters were investigated by cross-section transmission electron microscopy and concomitant changes in dopant profiles were monitored by Rutherford backscattering spectroscopy. The depth of the annealed or melted regions was found to increase linearly with pulse energy density and inversely with pulse duration. While dopant redistribution can provide information on total melt-life time and depth of melting, a gross underestimate of depth of melting in amorphous layers may be obtained, particularly near the threshold, if the dopant redistribution is less than 100 A. We found that transmission electron microscopy techniques were more reliable for accurate determination of melt depths. A minimum thickness of defect-free annealed or melted region of 400 A was achieved in the case of boron-implanted specimens. A maximum depth of melting up to 1 μ in these specimens could be achieved by 2.5 J cm^{-2} (25 ns) pulses. The quality of excimer laser annealing in terms of residual point defects and spatial inhomogeneity was found to be better than that achieved by pulsed ruby laser annealing.

20533 Recrystallization of amorphous gallium arsenide by ion beams. Sadana, D.K.; Choksi, H.; Washburn, J.; Byrne, P.F.; Cheung, N.W. (Department of Materials Science and Mineral Engineering and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Applied Physics Letters;* **44**: No. 3, 301-303(1 Feb 1984). Contract AC03-76SF00098.

An 11-MV arsenic beam was used to amorphize approximately 3.9 μm of GaAs surface layer at liquid nitrogen temperature. It was found that apparently amorphous gallium arsenide can be reconverted to single crystal by subsequent implantation at higher temperature. The recrystallization by the ion beam proceeded simultaneously from the amorphous surface and the deep amorphous/crystalline interface. Growth of dendrites and/or microtwins occurred at the recrystallizing interfaces. From the comparison of the nuclear stopping curve with the damage distribution in cross-sectional transmission electron micrograph, the threshold value for converting crystalline GaAs into amorphous GaAs was measured to be between $2—5 \times 10^{20}$ keV cm^{-3}.

20534 Observation of macroscopic collective behavior and new texture in magnetically doped liquid crystals. Chen, S.; Amer, N.M. (Applied Physics and Laser Spectroscopy Group, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **51**: No. 25, 2298-2301(19 Dec 1983). Contract AC03-76SF00098.

The observation of macroscopic collective behavior in a nematic liquid crystal doped with magnetic grains is reported. This behavior is manifested as a uniform molecular orientational distortion of the entire matrix upon the application of external magnetic fields as low as <1 G. The dependence of the distortion on field strength, dopant concentration, and sample thickness is presented, and a theory which quantitatively accounts for the results is given. At high field intensities, the doped nematic exhibits a heretofore unreported texture of complex cellular topology.

20535 **Tetramethyltetraselenafulvalenium perchlorate, $(TMTSF)_2ClO_4$, in high magnetic fields.** Chaikin, P.M.; Choi, M.; Kwak, J.F.; Brooks, J.S.; Martin, K.P.; Naughton, M.J.; Engler, E.M.; Greene, R.L. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104 and Exxon Research and Engineering Co., Annandale, New Jersey 08801). *Physical Review Letters;* **51**: No. 25, 2333-2336(19 Dec 1983). Contract AC04-76DP00789.

The Hall effect and the magnetoresistance of $(TMTSF)_2ClO_4$ have been measured at temperatures from 0.08 to 10 K and in magnetic fields to 22 T. The low-temperature data suggest a series of transitions induced by an orbital effect from the magnetic field which progressively reduce the carrier density. Oscillations, apparently Schubnikov—de Haas, also are observed above 10 T and at temperatures up to 10 K.

20536 **Field-induced magnetic order in bis-tetramethyl- p tetraselenafulvalenium perchlorate $(TMTSF)_2ClO_4$.** Azevedo, L.J.; Williams, J.M.; Compton, S.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] B: Condensed Matter;* **28**: No. 11, 6600-6602(1 Dec 1983). Contract AC04-76DP00789.

A microscopic study of the organic superconductor bis-tetramethyltetraselenafulvalenium perchlorate $[(TMTSF)_2ClO_4]$ has been undertaken with the use of nuclear magnetic resonance techniques. Proton and selenium resonances were recorded over the field range 60—120 kOe at a temperature of 1.5 K. The proton spin-lattice relaxation-rate measurements clearly reflect both the high-field phase transition and magnetotransport anomalies. The selenium resonance is strongly attenuated above the high-field transition which indicates the onset of field-induced magnetic order. These results and their bearing on the high-field electronic properties of the Bechgaard salts are discussed.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 19614, 19631, 19833, 19849

20537 **(ANL/NDM—84) ^{235}U and ^{239}Pu sample-mass determinations and intercomparisons.** Poenitz, W.P.; Meadows, J.W. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 43p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009493.

The masses of fifteen ^{235}U samples obtained from seven laboratories were determined and intercompared. The present results indicate that sample masses are well enough known (+- 0.3%) for the required high-accuracy-fission cross-section measurements. A comparison of four ^{239}Pu samples indicates problems in the order of 1 to 3% which are more likely, to be related to counting efficiencies than to sample masses. The half-life of ^{234}U was determined as $(2.457 \pm 0.005) \cdot 10^5$ yrs. 27 references.

20538 **(DOE/ER/10377—6) Fourier transform photoacoustic spectroscopy. Final report, April 1, 1979-March 31, 1984.** Eyring, E.M. (Utah Univ., Salt Lake City (USA)). Mar 1984. Contract AC02-79ER10377. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010216.

Technical accomplishments under this contract are reported since the inception of the contract on April 1, 1979 with somewhat greater emphasis given to work completed since the last progress report dated November, 1983. Photoacoustic spectroscopy is briefly described and then the program is reviewed for productivity and achievement of stated yearly objectives and long range goals. Specific recent achievements that are described include an infrared spectral study of quinoline adsorbed on a hydrodenitrogenation catalyst, a combined infrared photoacoustic-crossed polarization magic angle spinning solid state NMR investigation of several oxide bound organometallic complexes, an infrared clarification of the dependence of polyparaphenylene conjugation length on the polymer preparative method, an infrared study of the doping of this organic semiconductor with coordination compounds, a visible photothermal beam deflection spectral investigation of titanium metal corroded by a hot lubricant, and an intracavity laser photothermal beam deflection experiment.

20539 **(DOE/PC/51255—T1) Studies on transition metals and alloy Fischer-Tropsch catalysts, their electronic and bulk properties. (I: Fe/MnO; II: Fe/TiO_2; III: Fe/Mord.). Final report, July 1, 1982-September 30, 1983.** Mulay, L.N. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). Nov 1983. Contract FG22-82PC51255. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007304.

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The objectives were: (1) to characterize samples D1, 10% FeO/90% MnO, and D2, 48% FeO/52% MnO, under varying conditions of reduction (at 250°C or 350°C in H_2) and of syngas reaction 1:1 of CO:H_2 at 290°C) and in some cases use CO only for reduction and to identify species by Moessbauer Spectroscopy and Magnetization (σ/sub s) measurement; (2) similarly, to see if there is any metal (oxide)/support (Mordenite) interaction by the same techniques. The characterization was carried out with above techniques and the kinetic results for syngas were obtained on the above systems mostly at PETC. During reduction of Fe-oxide/Mn-oxide an intermediate Mn-ferrite phase was detected. After reduction, species such as $Fe^0 + Fe^{3+} + Fe^{2+}$ in varying total proportions (45% at 290°C and $Fe^0 + Fe^{2+}$ 75% were found at 350°C). Syngas conversion showed Fe-carbides ($Fe_2C_2 + Fe_5C$) depending on the reaction conditions, and the composition of D_1 and D_2. With the fresh γ-Fe_2O_3 (identified by Moessbauer) on Mordenites with varying ratios of SiO_2/Al_2O_3, a decrease in (σ/sub s/) was found with lowering of the ratios from 60 to 17. At 17% ratio (σ/sub s/) was smallest and the change in the isomer shift was maximum, which established an interaction with the Broensted cities. 24 figures.

20540 **(DOE/PC/60015—9) Separation and characterization of coal derived components. Quarterly report, 1 October 1983-31 December 1983.** Hurtubise, R.H.; Silver, H.F. (Wyoming Univ., Laramie (USA)). 16 Jan 1984. Contract AC22-83PC60015. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007386.

No new field-ionization data was obtained this quarter. For preasphaltenes, elemental analysis data was obtained on Kentucky and Wyodak preasphaltene samples. In conjunction with the preasphaltene work, solubility and thin-layer chromatography experiments were performed. The results indicated that basic alumina would not be useful as a general stationary phase for the separation of preasphaltenes. Several experiments were carried out with Chromasorb T, and the results showed it would be an adequate substitute for Fluoropak. The hydrocarbons in a sample from Pittsburgh Energy Technology Center were separated by the number of double bonds. The optimum mobile phases for the separation of monohydroxyl aromatics and dihydroxyl aromatics by reversed-phase liquid chromatography were obtained. In addition, a means of predicting retention in normal-phase chromatography was considered, and a NO_2 high-performance chromatographic column showed promise for the separation of compound classes. 6 references, 4 figures, 7 tables.

20541 **(IAEA-RL—101) Report on intercomparisons S-14, S-15, and S-16 of the determination of uranium and thorium in thorium ores.** Pszonicki, L.; Hanna, A.N.; Suschny, O. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Jun 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700730.

Twenty-nine laboratories from 18 countries took part in this intercomparison, organized by the IAEA's Analytical Quality Control Service, to help laboratories engaged in this task to check the reliability of their results. An additional aim was to establish the concentrations of thorium and uranium in three large batches of thorium ores and certifying them as reference materials. The evaluation was based on 438 individual results (108 laboratory means) for thorium, and on 412 individual results (106 laboratory means) for uranium. The number of laboratory means per element and per sample varied from 34 to 38. The methods most frequently used in the determination of both elements were neutron activation analysis and radiometry. They were followed by spectrophotometry and X-

ray fluorescence analysis for thorium and by fluorimetry, X-ray fluorescence analysis and spectrophotometry for uranium determination, respectively. The relative uncertainty of all computed overall medians which were used as the best estimations of true values, does not exceed +-10% and +-5% for the concentration values below and above 0.1%, respectively.

20542 **(IAEA-RL—102) Introduction to the problems of uranium analysis.** Suschny, O. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Aug 1983. 28p. (CONF-8309198—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700731.

From Inter-regional training course on uranium exploration and evaluation; Skofja Loka, Yugoslavia (5 Sep 1983).

Brief information is given on different techniques used for recognition, separation and determination of uranium. The analytical methods dealt with are: radiometry, neutron activation analysis, delayed neutron counting, X-ray fluorescence analysis, fluorimetry, spectral photometry, gravimetry, and volumetry. Selection of a suitable method for determining uranium in geochemical surveys is also discussed.

20543 **(IAEA-RL—103) Survey of currently available reference materials for use in connection with the determination of trace elements in biological materials.** Parr, R.M. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Sep 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700760.

Elemental analysis of biological materials is at present the subject of intensive study by many different research groups throughout the world, in view of the importance of these trace elements in health and medical diagnosis. IAEA and other organizations are now making a variety of suitable reference materials available for use in connection with the determination of trace elements in biological materials. To help analysts in making a selection from among these various materials, the present report provides a brief survey of data for all such biological reference materials known to the author. These data are compiled by the author from January 1982 to June 1983.

20544 **(IAEA-RL—104) Results of the analysis of the intercomparison samples of the depleted uranium dioxide SR-30.** Aigner, H.; Deron, S.; Zoigner, A.; Delle-Site, A. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Sep 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700732.

Samples of a homogeneous powder of depleted uranium dioxide, SR-30, were distributed to 38 laboratories in December 1980 for intercomparison of the precisions and accuracies of wet chemical assay. 16 laboratories reported their results. 12 laboratories applied titration procedures, 11 of them methods derived from the Davies and Gray procedure, 1 laboratory used controlled potential coulometry, 1 laboratory used fluorimetry, 1 laboratory U-232 spiking/alpha-spectrometry. One laboratory did not indicate the method applied. An analysis of variance yields for each laboratory the estimates of the measurement errors, the dissolution or treatment errors and the random calibration errors. The measurement errors vary between 0.01% and 3.41% relative. The differences to the reference value vary between -5.29% and +6.49% uranium, but 13 laboratories agree within +/-1% uranium with the reference value. The mean bias of these 13 laboratories is equal to +0.201% U. The standard deviation of the biases of these 13 laboratories is equal to 0.361% U.

20545 (KEK—81-16, pp 57-60) **SOR pulse and gas spectroscopic experiment.** Nakamura, Masatoshi; Morioka, Yumio (Tsukuba Univ., Sakura, Ibaraki (Japan). Inst. of Physics). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105236—).

From Meeting on pulsed structure of synchrotron radiation and its applications; Oho, Ibaraki, Japan (29 May 1981).

The coincidence measurement of SOR radiation and photoions was carried out. The photo-ionization process of oxygen molecules has been studied. The repetition time of the SOR pulses was too short, therefore, the single bunch operation of the SOR was done. Production ratio O^+/O_2^+ was measured from the obtained coincidence spectra, and it was 0.23/0.77 for the radiation of 537.2 x 10^{-8} cm. The ratio for other wavelength was also obtained. The results were mostly in agreement with the results obtained previously by the photoionization mass-spectrometry. In this experiment, the single bunch operation was not perfect. Accordingly, improvement on this point should be considered in a future machine.

20546 **(NIIAR—15(530)) Aluminium distribution in HDEHP-diluent-citric acid-DTPA extraction system and its effect on transplutonium and rare earth elements separation.** Kovantseva, S.N.; Nikolaev, V.M.; Kasimova, V.A.; Filimonov, V.T. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700733.

Aluminium extraction with HDEHP solutions in decane, containing isooctanol, from aqueous solutions of citric acid and DTPA is studied along with aluminium effect on curium, californium and europium extraction. It is shown that aluminium extraction with HDEHP solutions (in the interval of aluminium concentrations from 7.4 x 10^{-3} up to 2.23 x 10^{-1} mol/l) from citric solutions is described by the following expression: Alsub(B)sup(3+) + n(HA)sub(2sub(o)) reversible AlAsub(3)(2n - 3) x HA + 3Hsup(+), where n changes from 1.5 to 2.5 and is dependent on concentration of aluminium in an organic phase. Aluminium effect on curium, californium and europium distribution their extraction from citric solutions containing DTPA is explained by the change of extracting agent free concentration due to the formation of an aluminium complex and HDEHP of the $Al_3(2n - 3)$ x HA composition. The hdehp concentration changes in similar way for all coefficients of particular pairs of elements (Eu - Cm, Eu - Cf) remain practically unchanged. At aluminium concentration in an organic phase above 0.07 mol/l (Al ; HDEPH = 1:7) some increase in curium, californium and europium extraction observed.

20547 (NIRS-M—35, pp 107-118) **Transfer of radioiodine from the environment to animals and plants, (2). From sea water to marine organisms; Physicochemical forms in sea water.** Ikeda, Nagao (Tsukuba Univ., Sakura, Ibaraki (Japan)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

The chemical form of radioiodine and the physicochemical behavior of each individual form of radioiodine in the marine environment is still not so well known, owing partly to the lack of the appropriate analytical method. To study on these problems, the authors have first developed the radiochemical method of analysis for the individual forms of radioiodine. The method is based on the solubility of I_2 and CH_3I in carbon tetrachloride or toluene and on the difference of isotopic exchange behavior between I^- and IO_3^-. By shaking the sample sea water with carbon tetrachloride, $I^*{}_2$ and CH_3I^* can be extracted, if present. Among these, only $I^*{}_2$ can be back-extracted with sodium sulfite solution. I^{*-} and $I^*O_3^-$ can be determined by using the following isotopic exchange system: I^{*-} (aq.) + I_2 (org.) reversible I^- (aq.) + $I^*{}_2$ (org.). When the pH of the aqueous layer is adjusted to 4, only I^{*-} exchanges with I_2, while $I^*O_3^-$ does not. Therefore, the activity of the organic layer at the exchange equilibrium corresponds to that of I^{*-}. At pH 1, $I^*O_3^-$ reacts with I^- carrier to be converted to form, and the activity of the organic layer corresponds to the total activity of I^{*-} + $I^*O_3^-$. For organic solvent, the equi-volume mixture of carbon tetrachloride and toluene is found to be the most convenient among those tested.

20548 (NIRS-M—39, pp 293-308) **Introduction of new methods of analysis to promote the study of environment.** Ishikawa, Masafumi (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

The particle-induced X-ray emission (PIXE) analysis has been widely used for trace element analysis. This paper introduces the characteristics of PIXE method, and some examples of analyses

of environmental samples. The characteristics of the PIXE method are high sensitivity analysis, simultaneous multi-element analysis, scanning analysis, electron microscope analysis, and chemical form analysis. Two international conferences were held to discuss the problems on the PIXE method. Eighty three facilities in the world are engaged in the PIXE analysis. In Japan, the application to the material science has been made at 6 facilities. Recently, the application to biological and medical sciences has also been done. It is possible to obtain the distributions of trace elements in matrix by using a collimated beam. The beam can be collimated to a diameter of several micron with an electromagnetic lens. A PIXE spectrum of Hizikia fusiforme taken at the Cyclotron-Radioisotope Center, Tohoku University, is presented.

20549 **(TIM—689) Volumetric determination of uranium in the presence of columbium utilizing a bismuth metal reductor.** Jaworowski, R.J.; Bratton, W.D. (Pratt and Whitney Aircraft, Middletown, CT (USA). Connecticut Advanced Nuclear Engineering Lab.). 1 Jun 1961. Contract AC02-84PW02789. 4p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009909.

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The use of bismuth metal as a reducing agent during the determination of uranium in the presence of large amounts of columbium was studied. Other metals or metal amalgams reduce both uranium and columbium prohibiting a simple volumetric determination. When a strongly acid solution of uranium and columbium is passed through a column of bismuth metal the uranium (VI) is quantitatively reduced to uranium (IV) with no uranium (III) or columbium (III) being formed and without encountering the problem of columbium hydrolysis. The uranium is determined indirectly by reaction with excess iron (III) producing iron (II) which is titrated with standard cerium (IV) solution. The end point of the titration is determined potentiometrically. Interferences were encountered with iron, molybdenum, vanadium and tungsten in mixtures of uranium and columbium but not with nickel, zirconium, chromium, beryllium, copper, titanium and aluminum.

20550 (ZfI-Mitt—69, pp 9-23) **Reactor neutron activation analysis of industrial materials.** Niese, S. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The specific application of neutron activation analysis (n.a.a.) for industrial materials is demonstrated by the determination of impurities in BeO, Al, Si, Cu, Ge, GaP, GaAs, steel, and irradiated uranium. A group scheme gives an orientation about the possibilities of n.a.a. The use of different standards, methods for the measurement of low radioactivities and errors caused by recoil reaction and radiation stimulated diffusion are discussed.

20551 (ZfI-Mitt—69, pp 467-479) **Tracer research for the modelling of ion exchange equipment.** Mann, D. Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Tracer methods for the analysis of hydrodynamic behaviour and mass transfer in ion exchange were used to specify the mathematical model for the ion exchange columns. For the application of this model it is necessary to estimate the hydrodynamic parameters of the columns, the mass transfer coefficient in the liquid phase, and the effective diffusivity of the solid phase.

20552 **Catalytic functionalities of supported sulfides. II. Effect of support on Mo dispersion.** Massoth, F.E.; Muralidhar, G.; Shabtai, J. (Univ. of Utah, Salt Lake City). *Journal of Catalysis;* **85**: No. 1, 53-62(Jan 1984).

Several Mo and CoMo catalysts on different supports, previously evaluated for thiophene hydrodesulfurization (HDS) and 1-hexene hydrogenation (HYD) activities, were characterized for Mo dispersion in the catalysts. Techniques employed for characterization included XRD, ESCA, and O_2 chemisorption of catalysts, and determination of "active OH" on supports. For the calcined (oxide) form of Mo and CoMo catalysts on Al_2O_3, several SiO_2-Al_2O_3 compositions, and SiO_2, it was found that essentially monolayer dispersion of the Mo was present on Al_2O_3 and low SiO_2-containing supports, whereas in the case of high SiO_2-containing and SiO_2 supports evidence was found for three-dimensional crystallites for the Mo phase. The sulfided form of these catalysts gave essentially the same results. These findings are interpreted in terms of the degree of interaction of the Mo phase with the support. To account for changes in HDS and HYD activities of the catalysts, it is proposed that HDS occurs at vacancies on corner sites and HYD at vacancies on edge sites of the MoS_2 phase present. 5 figures, 5 tables.

20553 **Design and synthesis of optically-pure compounds using microbial systems.** Sih, C.J.; Chen, C.S.; Girdaukas, G.; Zhou, B.N. (Univ. of Wisconsin, Madison). pp 215-230 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

As the useful biological activities of most therapeutic agents are associated with only one enantiomer, the preparation of optically-pure compounds continues to be a major contemporary problem of synthetic organic chemistry. Conventional chemical transformations generally give statistical mixtures of optical enantiomers requiring resolution by an asymmetric agent. We have developed basic equations and useful graphs for the unified treatment of biochemical kinetic resolution data. These expressions have been verified experimentally and possess predictive value in relating the important components of the extent of reaction, enantiomeric excess and the enantiomeric ratio. This quantitative format has greatly facilitated our preparation of a series of valuable bifunctional chiral synthons using microbial carboxyesterases.

20554 **Covalent binding of isomeric benzo[a]pyrene diol-epoxides to DNA.** MacLeod, M.C.; Mansfield, B.K.; Selkirk, J.K. (Oak Ridge National Lab., TN). *Carcinogenesis (New York);* **3**: No. 9, 1031-1037(1982). Contract W-7405-ENG-26.

The authors have compared the abilities of two diol-epoxide derivatives of benzo[a]pyrene (B[a]P) to bind covalently to DNA in a simple in vitro system. Purified DNA in aqueous solution was allowed to react with (+/-)-7α,8β-dihydroxy-9β,10β-oxy-7,8,9,10-tetrahydroB[a]P (BPDE) or with (+/-)-9α,10β-dihydroxy-7α,8α-oxy-7,8,9,10-tetrahydroB[a]P (reverse BPDE) to completion. After repurification of the DNA, binding was detected by fluorescence spectroscopy or by absorbance spectroscopy. Both BPDE and reverse BPDE but not their hydrolysis products exhibited binding which increased linearly with increasing diol epoxide concentration. When DNA modified by reverse BPDE was enzymatically hydrolysed, two major fluorescent deoxyribonuclioside-adducts were detected by reverse phase h.p.l.c. Absorbance and fluorescence spectroscopy of modified native DNA suggested that the pyrene nucleus of reverse BPDE but not of BPDE was intercalated in the DNA double helix. This suggestion was supported by fluorescence-quenching studies. Covalent binding of reverse BPDE to DNA was effectively blocked by low concentrations of Mg^{2+}, suggesting that formation of a non-covalent intercalation complex may be a prerequisite for covalent reaction.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 19670, 20431, 20547, 20612

20555 **(CONF-840140—2) Brillouin scattering on H_2O above 70 GPa: transition to symmetric ice (ice X).** Polian, A.; Besson, J.M.; Grimsditch, M. (Argonne National Lab., IL (USA); Paris-6 Univ., 75 (France). Lab. de Physique des Milieux tres Condenses). Feb 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009162.

From International symposium on solid state physics under pressure; Izu-Nagaoka, Japan (18 Jan 1984).

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H_2O and D_2O have been studied by Brillouin scattering under high pressure. Up to 35 GPa, the effective longitudinal elastic constants exhibit similar behavior in contrast with the behavior of the bulk modulus. H_2O was studied up to 74 GPa. A phase transition occurs around 46 GPa. This high pressure phase, ice X, is probably the hydrogen-symmetric centered cubic phase.

20556 **(NP—4770184) Synthesis of ^{13}C-labelled acetylene compounds and their ^{13}C-NMR- and mass spectrometric investigation.** Brehm, M. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Synthetische und Analytische Chemie). 16 Jun 1978. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770184.

^{13}C NMR signals of the sp hybridized C atoms of a tetrain and pentain could be clearly assigned by comparing with the spectra of the corresponding ^{13}C labelled compounds synthesized for this purpose. To clarify the question of whether a conjugation takes place via several triple bonds, a series of di and triinalcohols as well as the corresponding aldehydes or ketones were synthesized. The application of the ^{13}C NMR spectroscopy as probe for electron density distributions in π systems showed that an electron flow is conducted just as well with polyinene as the analogous polyenene.

20557 **Effect of fluoride preparation on the purity of the rare earth metals.** Beaudry, B.J.; Palmer, P.E.; Gschneidner, K.A. Jr. (Ames Lab., IA (USA)). *Journal of the Less-Common Metals;* **93**: No. 2, 277(15 Sep 1983). (CONF-830419—).

From 16. rare earth research conference; Tallahassee, FL, USA (18 Apr 1983).

Published in summary form only.

20558 **Preparation and properties of electrically conducting ceramics containing rare earths.** Marchant, D.D.; Bates, J.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Journal of the Less-Common Metals;* **93**: No. 2, 447-448(15 Sep 1983). (CONF-830419—).

From 16. rare earth research conference; Tallahassee, FL, USA (18 Apr 1983).

Published in summary form only.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 19629, 19633, 19670, 19871, 19874, 19876, 20547

20559 (KURRI-TR—217, pp 65-68) **C-13 solid high resolution NMR in polyacetylene and its derivative.** Terao, Takehiko; Maeda, Shiro (Kyoto Univ. (Japan). Faculty of Science); Yamabe, Tokio; Akagi, Kazuo; Shirakawa, Hideki. 1982. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. (CONF-811294—).

From Meeting on physics and chemistry of organo polymer semiconductors; Kumatori, Osaka, Japan (18 Dec 1981).

The NMR study on polyacetylene has been made to make clear the fine structure of carbon skeleton, cis-trans isomerization mechanism, and the mechanism of conductivity. Samples of cis-polyacetylene film were made by the Shirakawa's method, and samples of trans-polyacetylene were made from the cis samples by thermal isomerization. The concentration of C-13 was enriched to 5.8 percent. The tensor values of chemical shift of polyacetylene and the values of isotropic average shift were obtained from the NMR spectra. A signal of methylene was observed in the CP/MAS spectra of trans-polyacetylene. The CP/MAS spectra of oxidized trans-polyacetylene were measured to study the oxidation mechanism. The process of thermal isomerization was studied by measuring the spectra in the course of isomerization of cis samples. The isomerization occurred at random. The CP/MAS spectra of the derivative of trans-polyacetylene were observed. A broad absorption line was seen at the higher magnetic field side of the absorption line of the trans-polyacetylene. This line may be due to covalent bond with dopant.

20560 **Industrial production of optically active compounds using immobilized biocatalysts.** Chibata, I. (Tanabe Seiyaku Co., Ltd., Osaka, Japan). pp 465-496 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

Techniques that began with immobilized enzymes have developed to immobilized microbial cells, immobilized living microbial cells, and further to immobilized plant and animal cells. These immobilized systems are applied in a variety of fields, including sterochemical synthesis of L-amino acids and L-malic acid, and play a very important role in enzyme engineering in the field of biotechnology. The potential applicability of genetic engineering to enhance productivity and applicability of enzyme engineering are discussed.

20561 **Unconventional catalytic properties of conventional enzymes: applications in organic chemistry.** Klibanov, A.M. (Massachusetts Inst. of Tech., Cambridge). pp 497-518 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

In addition to their normal reactions (reflected in their names), enzymes often can catalyze other, sometimes quite different processes. Although unimportant for the enzyme-producing organism, these alternative reactions can be very valuable for biotechnological applications. The examples of unnatural catalytic activities of common enzymes that are considered, taken from the author's recent studies, include: (1) reduction of aromatic compounds catalyzed by glucose oxidase; (2) prochiral and enantiomeric stereospecificity of galactose oxidase in the oxidation of nonsugar, three-carbon alcohols; (3) selective hydroxylation of aromatic compounds catalyzed by peroxidase; and (4) geometrically and positionally specific oxidation of aromatic aldehydes catalyzed by xanthine oxidase.

4004 Electrochemistry

20562 **(CONF-840555—1) Metal dissolution kinetics in halide melts.** Settle, J.L.; Nagy, Z. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84004030.

From Spring meeting of the Electrochemical Society; Cincinnati, OH, USA (6 May 1984).

Although the kinetics and mechanism of the anodic dissolution of metals is an important aspect of corrosion studies, few such measurements have been carried out in high-temperature molten salts, mainly because of experimental difficulties caused by the high temperature and the high rate of the reactions. In this work the dissolution kinetics of nickel, iron, and molybdenum has been investigated in several halide melts. These melts were the eutectic mixtures of LiCl-KCl, LiCl-RbCl-$CaCl_2$, LiBr-KBr-CsBr, and NaCl-$NaAlCl_4$, containing 10^{-7} to 10^{-4} mol cm^{-3} chloride of the metal under investigation. The measurements were carried out in the temperature range of 175 to 550°C. The measurement techniques used were D.C. relaxation techniques, mainly double pulse galvanostatic, but also single pulse galvanostatic, and coulostatic techniques. The results of these measurements will be presented, compared to previously reported exchange current densities, and discussed in the light of the applicability limitations of each measurement technique for fast reactions.

20563 **(DOE/ER/04445—T4) Electrochemistry of carbides and carbon cathodes in molten halides. Final report.** Selman, J.R. (Illinois Inst. of Tech., Chicago (USA). Dept. of Chemical Engineering). Jun 1983. Contract AC02-77ER04445. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007966.

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During the six-year period 1977 to 1983 the electrochemistry of lithium and calcium carbides and of carbon cathodes was investi-

gated with emphasis on: (1) the characteristics of carbon electrode potentials in carbide-containing melts; (2) the behavior of carbon as an intercalating cathode in lithium-based melts. A direct connection between the carbon/carbide electrochemistry and the intercalation kinetics of graphite was demonstrated in the case of lithium, with likely extension to calcium. Five intercalation stages of lithium were identified by coulometry and their lithium activity measured for the first time, by the emf method. The diffusivity of lithium in graphite was also determined for the first time, as a function of the intercalation stage. The above results were, or are being, reported in eight publications. Molten-salt experiments and modeling analyses, carried out in preparation for the intercalation experiments, are reported in five additional publications. Support is also acknowledged for seven major review papers dealing with molten-salt systems and transport-property related techniques.

4005 Photochemistry

REFER ALSO TO CITATION(S) 19902

20564 **(DOE/ER/13102—1) Photoexcited charge pair escape and recombination. Progress report, July 1, 1983-February 28, 1984.** Braun, C.L. (Dartmouth Coll., Hanover, NH (USA). Dept. of Chemistry). Feb 1984. Contract AC02-83ER13102. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009423.

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The recombination dynamics of geminate cation-electron pairs in liquid hexane was studied by combining picosecond optical excitation with sensitive photoconductivity measurements. The experiments monitor the generation of free charge carriers by photoassisted geminate pair dissociation. The charge-pair survival probability is given approximately by the photoconductivity signals measured as a function of the delay time between photoionization and infrared photodissociation. The time course of the charge pair annihilation is compared with transient solutions of the Smoluchowski equation governing diffusive recombination in a Coulomb well. Agreement between theory and experiment can only be reached by allowing for a distribution of charge pair separation. Theoretical work relevant to the generation of free electrons and holes (or anions and cations) in electron donor-acceptor materials has been completed. The lowest charge-transfer excited state (CT_1) of electron donor-acceptor crystals or polymers is demonstrated to be a plausible precursor of free charge carriers when such materials are photoexcited. Rate constants for the dissociation of charge-transfer states are formulated for two approximate descriptions of CT_1: classical ion pair and Wannier exciton. The electric field dependence of the dissociation rate constant is postulated to be given by Onsager's 1934 theory [0-34] of ion pair dissociation.

20565 **(LA-UR—84-1104) Capabilities of broadly-tunable free-electron lasers.** Newnam, B.E. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 19p. (CONF-840139—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009998.

From SPIE technical symposium and instrument exhibit; Los Angeles, CA, USA (22 Jan 1984).

Recent experimental demonstrations of free-electron laser oscillators are attracting the attention of research and industrial chemists. We review the inherent properties of these photon sources, the operating parameters of successful oscillators, and potential chemical applications.

20566 **(LBL—17380) Surfactant manganese complexes as models for the oxidation of water.** Wohlgemuth, R.; Otvos, J.W.; Calvin, M. (Lawrence Berkeley Lab., CA (USA)). Feb 1984. Contract AC03-76SF00098. 13p. (CONF-8308110—8). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009216.

From 6. international congress on photosynthesis; Brussels, Belgium (1 Aug 1983).

Surfactant manganese complexes have been studied spectroscopically and electrochemically as models for the catalysts involved in the photooxidation of water to produce oxygen. Evidence has been obtained for the participation of the suggested redox cycle Mn/sup II/ to Mn/sup III/ to Mn/sup IV/ and back to Mn/sup II/ with the evolution of oxygen.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 20523

20567 **(INR—549/17) Formation of hydrogen peroxide in gamma irradiated frozen alkaline solutions of high concentration.** Zagorski, Z.P.; Weimann, L. (Institute of Nuclear Research, Warsaw (Poland)). Jul 1964. 12p. NTIS (US Sales Only), PC A02. Order Number DE84901000.

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It has been found that in gamma irradiated, strong alkaline deaerated solutions no hydrogen peroxide can be found. This product, however, was found in the melt gamma irradiated, deep frozen solutions of the same composition. G values varied from 0 to 0.2, depending on the temperature of irradiation, time of irradiation and the presence of carbonates. It is assumed that the larger production of blue species, identified as stabilized solvated electron, the more hydrogen peroxide is accumulated in the melt.

20568 (KEK—81-16, pp 25-28) **Current status of picosecond pulse radiolysis.** Tagawa, Seiichi (Tokyo Univ. (Japan). Research Center for Nuclear Science and Technology); Katsumura, Yosuke. Jan 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105236—).

From Meeting on pulsed structure of synchrotron radiation and its applications; Oho, Ibaraki, Japan (29 May 1981).

History of picosecond pulse radiolysis is described. There are several groups, in the world, which are doing the experiment with picosecond time resolution. Characteristics of these systems and techniques are classified by radiation source and detection technique. Advantage of the comparative experiment between SOR and pulse radiolysis in radiolysis in radiation chemistry is reported briefly.

20569 (ZfI-Mitt—69, pp 362-367) **Cross-linking and free radical decay reactions in irradiated polyethylene in the presence of additives.** Jaworska, E. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The blends of low-density polyethylene and additives of flame retardant type (tetrabromobisphenol A, octabromodiphenyl ether, and Sb_2O_3) were irradiated with ^{60}Co gamma radiation and with 13 MeV electrons from linac at temperatures of about 313 K. ESR measurements were performed just after irradiation and after storage at room temperature. A correlation between the concentration of allyl radicals and gel content was found.

20570 (ZfI-Mitt—69, pp 377-380) **Technological aspects of planar structurizing on woven and knitted fabrics by localized radiation-induced grafting.** Bobeth, W.; Hanke, R.; Heger, A.; Morgenstern, J.; Paessler, H. (Akademie der Wissenschaften der DDR, Dresden. Inst. fuer Technologie der Fasern). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Two technological variants of fabric finishing by radiation-induced grafting of fabrics consisting of polyamide and acrylamide are presented. In the first variant inhomogeneous irradiation (500 keV electrons) is carried out covering the fabric with a perforated metal sheet acting as a stencil. In the second one, certain areas of the homogeneously irradiated fabric are subjected to higher temperatures using an engraved roller. The local grafting leads to structurizing, a greater moisture absorption capacity, and an additional color pattern.

20571 (ZfI-Mitt—69, pp 381-390) **Problems in the development of high-energy radiation processing of woven and knitted fabrics.** Ihme, B.; Maeder, E.; Mally, A. (Akademie der Wissenschaften der DDR, Dresden. Inst. fuer Technologie der Fasern). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Modification of clothing-hygienic properties of polyamide and polyester planar structures was investigated. Experiments were done with the simultaneous procedure, applying the modificator in the liquid phase. Depending on the process conditions the localization of the second component takes place within the whole cross-section of the fibre resulting in volume effects (modification of polyamide by acrylic acid), within a more or less thick surface layer resulting in partial volume effects, or within a mantle resulting only in surface effects (modification of polyester by polyethyleneglycolacrylate). The paper underlines the fact that the radiation-chemical modification for the enlargement of the utility value of textile planar structures is a relatively complicated process of textile finishing with the need of additional application of chemicals, plants, workmen and energy.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 19821, 20098, 20099, 20881

20572 **(JAERI-M—82-169) Radioactive nuclides in nuclear reactors.** Akatsu, Eiko. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 141p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84700734.

In the Nuclear Engineering School of JAERI, many courses are presented for the people working in and around nuclear reactors. The curricula of the courses contain also chemical subject materials. With reference to the foreign curricula, a plan of educational subject material of chemistry was considered for students of the school in the previous report (JAERI-M 9827), where the first part of the plan, "Fundamentals of Reactor Chemistry", was reviewed. This report is a review of the second part of the plan containing fission products chemistry, actinoids elements chemistry and activated reactor materials chemistry.

20573 (ZfI-Mitt—69, pp 42-54) **Labelling with generator nuclides.** Otto, R.; Hecht, P. Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Short-living radioisotopes separated from the commercially available Mo/Tc-, Sn/In- and Te/I-generators and the self-made Ba/La-generator are used for labelling in industrial tracer experiments. The transfer of the daughter nuclides from the generator eluates into organic phases and the labelling of oil phases and solid particles are investigated. The developed simple, quick and efficient methods are suitable for routine application under industrial conditions. Some examples of industrial applications of the generator nuclides in mixing and dynamic function studies are given, too.

20574 **(ZfK—496) Annual report 1981/1982. Radioactive Isotope Department.** Muenze, R. (ed.). (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Feb 1983. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700772.

Results of investigations in the field of the production of radioisotopes, the synthesis of radioactive compounds and their characterization are presented. Main topics are the production of ^{99}Mo and the application of radioactive compounds in nuclear medicine especially as radiopharmaceuticals. A list of publications and lectures is enclosed.

20575 **Syntheses, lattice parameters and solid state absorption spectra of the first five transplutonium orthophosphates.** Haire, R.G.; Hellwege, H.E.; Hobart, D.E.; Young, J.P. (Oak Ridge National Lab., TN (USA)). *Journal of the Less-Common Metals;* **93**: No. 2, 358-359(15 Sep 1983). (CONF-830419—).

From 16. rare earth research conference; Tallahassee, FL, USA (18 Apr 1983).

Published in summary form only.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

20576 **(AD-A—134738/4) Overall reaction concept in premixed, laminar, steady-state flames. I. Stoichiometries. Final report.** Coffee, T.P.; Kotlar, A.J.; Miller, M.S. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Oct 1983. 43p. (ARBRL-TR—02528). NTIS, PC A03/MF A01.

Combustion processes normally involve a large number of chemical species, related through a complicated reaction network and strongly interacting with the fluid flow and molecular transport. A common approach is to simplify the system by assuming a single overall or global reaction. In this paper, we will examine the adequacy of the overall reaction model for premixed, laminar, one-dimensional, steady-state flames. Our procedure is to first solve the equations governing the detailed chemistry model. The overall reaction rate parameters are then found from a least squares fit of the heat release profile. The overall reaction model equation can then be solved and the solution compared with the detailed model solution. This is done for three different flames over a range of stoichiometries. The single reaction model gives quite accurate results for flame speed. The temperature and heat release profiles are also generally accurate. The accuracy of the major species profiles varies from fair to good. However, the optimal overall kinetic parameters do vary with stoichiometry.

20577 **(AD-A—134740/0) Intracavity laser excitation of NCO fluorescence in an atmospheric pressure flame. Final report.** Anderson, W.R.; Vanderhoff, J.A.; Kotlar, A.J.; DeWilde, M.A.; Beyer, R.A. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Sep 1983. 43p. (ARBRL-TR—02527). NTIS, PC A03/MF A01.

Laser excited fluorescence of the NCO radical has been obtained using discrete prism selected lines of an argon ion laser pump source. To our knowledge, this is the first time NCO fluorescence has been obtained in a flame environment. NCO was formed in a slightly rich atmospheric pressure CH4/N2O flame. This flame was placed inside the extended cavity of the argon laser to take advantage of the much higher light intensity levels. All of the available laser lines pump vibrational hot bands of the NCO A doublet-sigma- plus to X doublet-pi system. The 4658 Angstom line appears to be the most useful for probing NCO densities. This line pumps from vl=1 in the X state to the lowest vibrational level of the A state. NCO is pumped to N prime = 31 by this line, probably via the Q2(31) transition although the R2(30) and P(32) transitions could not be ruled out in the present analysis. The 4658 Angstrom line was used to determine a relative NCO density profile through the reaction zone of a Ch4/N2O flame. Profiles of C2, CN, and temperature were also obtained in this flame and are compared with the NCO profile. A lower limit of approximately 3x10 to the 14th power CM-3 was placed on the peak NCO density in the flame. Attempts to find NCO or CN fluorescence in a CH4/air flame failed, indicated probable differences in nitrogen chemistry for the two flames.

20578 **(DOE/ER/10505—T2) Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, July 1, 1983-June 30, 1984.** Kern, R.D.; Pamidimukkala, K.M.; Patil, M.D.; Wu, C.H.; Esslinger, M.A.; Winkeler, T.J. (New Orleans Univ., LA (USA). Dept. of Chemistry). 1984. Contract AS05-79ER10505. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008352.

It has been shown that each of the experimental techniques mentioned, LS, ARAS, and TOF (laser schlieren, atomic resonance absorption spectroscopy, time of flight), have a particularly important role to play in the elucidation of complex reaction schemes that are the rule in fossil fuel pyrolytic systems. Each of these three methods have been combined to produce an understanding of complicated problems that is greater than the sum of three individual efforts: to wit, ARAS can monitor the time history of H or D atom

production in very dilute systems (LS and TOF cannot); LS can provide information about the enthalpy changes occurring (ARAS and TOF cannot); TOF can record the time histories of major and minor (not trace amounts) species that appear during the course of the reaction and also detect in some cases transient intermediates (e.g., phenyl or lack thereof, C_4H_4, C_4H_3, C_7H_7).

42 ENGINEERING

4201 General Engineering

20579 (SAND—83-1889C) Combined experimental/analytical modeling using component mode synthesis. Martinez, D.R.; Carne, T.G.; Gregory, D.L.; Miller, A.K. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 13p. (CONF-8405127—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008293.

From 25. AIAA/ASME/ASCE/AHE structures, structural dynamics and materials conference; Palm Springs, CA, USA (14 May 1984).

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This study evaluates the accuracy of computed model frequencies and mode shapes obtained from a combined experimental/analytical model for a simple beam structure. The structure was divided into two subsystems, and one subsystem was tested to obtain its free-free modes. Using a Component Mode Synthesis (CMS) technique, the experimental model data base for one subsystem was directly coupled with a finite element model of the other subsystem to create an experimental/analytical model of the total structure. Both the translational and rotational elements of the residual flexibilities and mode shapes at the interface of the experimental subsystem were measured and used in the coupling. The modal frequencies and mode shapes obtained for the combined experimental/analytical model are compared to those for a reference finite element model of the entire structure. The sensitivity of the CMS model predictions to errors in the modal parameters and residual flexibilities, which are required to define a subsystem, is also examined.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 19735, 19767, 20257, 20258, 20259, 20291, 20522, 21533, 21534, 21537, 21571

20580 (EUR—8057) Stowing of packages containing radioactive materials on conveyances. Phase 1. Draulans, J.; Lafontaine, I. (Commission of the European Communities, Luxembourg). 1982. 118p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700778.

The study includes the redaction of a reference document that would give directives concerning the stowing of packages on ground transportation means. These directives would exclusively cover the mechanical loads to which the packages are subjected in normal or accidental transport conditions. Regulatory prescriptions have been collected in Belgium, France, the United Kingdom, Italy, the Netherlands, the Federal Republic of Germany, Sweden and the U.S.A. Additionally, advisory prescriptions and information have been received from national or international organizations, as well as from companies specialized in road and railway traffic. On the basis of a large inquiry made with truck- and waggon manufacturers about generated deceleration forces involved during transport vehicles and train accidents, and about forces taken into account for the construction of these equipments, some interesting information has been collected. The most current standards concerning the strength of the stowing for road transportation are in the three directions (longitudinal, lateral and vertical) respectively 2g - 1g - 1g, while the maximum values are respectively 10g - 5g - 2g. For railway transportation, the standards in many European countries are 4 g - 0,4 g - 0,3 g. While data concerning the normal railway traffic are coherent, no reliable data exist for accidents including the impact of vehicles against rigid obstacles.

20581 (FERMILAB/TM—1245) Simulation program for central helium liquefier. Kawamura, S. (Fermi National Accelerator Lab., Batavia, IL (USA)). 20 Feb 1984. Contract AC02-76CH03000. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009866.

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The computer program described here analyzes the performance of Fermilab Central Helium Liquefier (CHL) and predicts the values of the plant thermodynamic variables at all process points in the plant. To simulate CHL, this program is modified from the prototype program which was developed by Hitachi Ltd. a couple of years ago. This program takes care of only the steady state simulation and takes account of the change of the turbine efficiency, the pressure drops and the UA values of the heat exchangers. How to use the program is shown.

20582 (IFVE-OUNK—82-158) Tests of the KGU-400/4.5 plant in non-standard operating modes. Ageev, A.I.; Zinchenko, S.I.; Logachev, S.N.; Murav'ev, M.V.; Shamichev, A.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700776.

Results of experimental study of a commercial cryogenic helium plant of the KGU-400/4.5 type operating in the mode with time-varying heat load at helium temperatures and in the mode with excessive return flow rate are presented. It has been found, that at the heat load variation factor lower than 2 and with heat load step duration $t < 1$ min there is no cooling capacity change. When $t > 1$ min the plant operation is possible only with liquid helium consumption. Time behaviour of the second expander exit flow temperature is presented. It is shown, that with $t > 5$ min expander temperatures become too low and the plant is out of operation. One of the ways to achieve higher reliability in the expanders failure situation is considered. That is transition to the operating mode with excessive return flow rate. It is shown, that even when all expanders are out, the plant can work with cooling object for some hours provided enough liquid helium supply. This time can be used for repairs.

20583 (JAERI-M—82-201) Shielding experiments for evaluating a shielding safety evaluation code system to spent fuel processing facilities, (1). Shielding experiment of a spent fuel transport cask for a PWR spent fuel assembly. Tanaka, Shun-ichi; Sakamoto, Yukio; Yamaji, Akio. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 65p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700779.

Shielding experiments of a spent fuel transport cask were performed using a PWR spent fuel assembly according to the experimental plan to confirm the reliability of a shielding safety evaluation code system and data libraries. The purpose of the experiments is to obtain the data by which the overall reliability of a shielding safety evaluation code system and the nuclear data librarries are examined. The measurements were made on gamma rays and neutrons outside and inside a spent fuel transport cask. The distributions outside the cask were measured for gamma-ray exposure dose rate, neutron dose equivalent rate, energy spectra of gamma rays and fast neutrons, and thermal and epithermal neutron reaction rate. And, the distributions inside the cask were measured for gamma-ray exposure dose rate and reaction rates of $^{235}U(n, f)$ and $^{232}Th(n, f)$ reactions. The gamma-ray exposure dose distribution was also taken in the cask lid. This report gives the data on experimental conditions and detector characteristics necessary for the analysis of the measured data as well as the detail of measured data.

20584 (LA-UR—84-745) Magnetic refrigeration: the promise and the problems. Barclay, J.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-8404116—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007481.

From 21. space congress; Cape Kennedy, FL, USA (24 Apr 1984).

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Magnetic refrigeration uses the temperature- and field-dependence of the entropy of some magnetic materials to accomplish

cooling. Because of the intrinsically high efficiency of the magnetization and demagnetization process and because of the potential for excellent heat transfer between solids and fluids, magnetic refrigerators promise to have higher efficiency than existing gas-cycle refrigerators. Many ground-based and space-based applications could benefit significantly from the cost savings implied by higher efficiency. Other attributes of these devices are high reliability and low volume and mass per unit cooling power. The development of these refrigerators is underway at several places around the world, including the Los Alamos National Laboratory. The progress to date has been encouraging but some problems have been clearly identified. The arguments for high efficiency and the problems that will need to be solved to achieve this goal are discussed.

20585 **(NIIEFA-P-A—0522) Structural and parametric analysis of vacuum surface-action pumps. Pt. 2. Comparative parameters of pumps with a uniform preliminary formed sorbtion layer.** Deev, S.D.; Saksaganskij, G.L. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700777.

Functions of absorbed gas flow relative density spatial distribution, capture coefficients, integral criteria and similarity factors for eight most widely used modification of surface-action vacuum pumps with a uniform preliminary formed sorption layer are presented. Calculations are performed for systems with uniform distribution of molecular concentration as well as for typical variants of directed molecular flows.

20586 **(NLCO—1107-Rev.1) Safety analysis report for packaging steel banded wooden shipping containers for slightly enriched uranium metal.** Dolan, L.C. (NLO, Inc., Cincinnati, OH (USA)). Oct 1983. Contract AC05-76OR01156. 156p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84010109.

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An analytical evaluation of the NLO, Inc. steel-banded wooden shipping container family has been made in order to demonstrate its compliance with regulations governing the offsite shipment of radioactive materials. The evaluation encompasses four primary categories: structural integrity, thermal integrity, nuclear criticality safety and quality assurance. The results of this evaluation show that the container family complies with the regulations as outlined in 10CFR71 for the shipment of various uranium metal shapes enriched up to 1.25% ^{235}U. 15 references, 37 figures.

20587 **(ORNL/Sub—81/70519/1) Utilization of amorphous metals in electric motors. Power systems technology program.** Johnson, L.A. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center). Mar 1984. Contract AC05-84OR21400. 121p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84009483.

The objective of this work has been to establish the feasibility of producing amorphous metal in a form which could be utilized in a motor core at low cost while retaining its excellent magnetic properties. The approach taken was to develop a process for casting amorphous metal in the form of a continuous helical ribbon in order to avoid the necessity of handling individual laminations. A second objective was to either: (1) establish the feasibility of directly casting conductor slots in the amorphous metal ribbon or (2) develop a means for rapid, inexpensive formation of the conductor slots after casting the helical ribbon.

20588 **(PB—84-124775) Field investigation and analysis of buried pipelines under various seismic environments. Technical report.** Wang, L.R.L. (Oklahoma Univ., Norman (USA). Fears Structural Engineering Lab.). Aug 1982. 20p. NTIS, PC A02/MF A01.

A research project is proposed in which the behavior of oil, water, sewer, and gas pipelines under various seismic environments, including seismic shaking and large ground deformation would be investigated. It is suggested that the investigation be conducted in the Beijing and Tangshan areas. Three major hazards to underground pipelines are identified: the effect of wave propagation; ground rupture and differential movement along fault lines; and soil liquefaction induced by ground shaking. Ruptures or severe distortions of the pipe are most often associated with fault movements, landslides, or ground squeeze associated with fault zones. A model is presented to evaluate the general longitudinal responses of buried pipelines, both segmented and continuous, subjected to ground shakings and vibrations. The results of these tests will be used to develop aseismic codes for buried pipelines.

20589 **(PNCT—831-80-01, pp 98-105) In-situ dismantling of plutonium-contaminated glove box.** Numata, Koji; Watanabe, Hisashi; Ishikawa, Hisashi; Miyo, Hiroaki; Ohtsuka, Katsuyuki (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1980. NTIS (US Sales Only), PC A09/MF A01.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Jan 1979 - Mar 1980.

A plutonium-contaminated glove box was dismantled along with the development of the treatment techniques for plutonium-bearing wastes. The objectives of this in-situ dismantling of the glove box are to reuse the Plutonium Fuel Fabrication Facility more efficiently, to reduce the volume of wastes generated during the dismantling, and to acquire dismantling techniques for decommissioning the Plutonium Fuel Fabrication Facility in the future. Prior to the dismantling works, a greenhouse for decontamination was installed, and the decontamination with surfactants was performed. Unremovable contamination was coated with paint. After this greenhouse was removed, the main greenhouse for dismantling and three greenhouses for contamination control were assembled. The main workers wearing protective devices engaged in dismantling works in the greenhouse. As the protective devices, anorak type PVC suits with air line masks, Howell type pressurized suits, and respirators were used. The tools used for the dismantling are a plasma cutter, an electric nibbler, an electric disk grinder, an electric circular saw and an electric jig saw. The results of the dismantling in-situ were compared with two previous cases of dismantling carried out by different procedures. In the case of in-situ dismantling, the volume of wastes was 1.6 - 1.8 m^3/m^3 of glove box, and considerable reduction was realized.

20590 **(SAND—83-8011) SHELL SHOCK structural code (fourth edition).** Grant, J.E.; Gabrielson, V.K. (Sandia National Labs., Livermore, CA (USA)). Mar 1984. Contract AC04-76DP00789. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84009549.

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SHELL SHOCK is a computer code that performs a frequency analysis and determines the static and dynamic response of a structure represented by mass, damping, and stiffness matrices. SHELL SHOCK is primarily intended for analyzing three-dimensional axisymmetric structures modeled using structural elements generated by the code in which the spatial coordinates are uncoupled by Fourier harmonics. A three-dimensional axisymmetric structure is then reduced to a series of two-dimensional problems, which significantly reduce the computations required. Three types of structural elements (that are uncoupled by a Fourier series) are generated internally by the code: linear beams, shells, and solids of revolution. Nonlinear beam elements are also uncoupled and included in the dynamic response computations. 6 references, 15 figures, 4 tables.

20591 **(UCID—20034) Design of a safety monitor system for high explosives machining.** Newton, L.E.; Garske, J.D.; Shimamoto, F.Y.; Yamauchi, R.K. (Lawrence Livermore National Lab., CA (USA)). 28 Nov 1983. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84010101.

A computerized Safety Monitor System was recently designed for and installed on a Bostomatic Mill/Lathe at Site 300. This report includes a brief description of previous safety modifications made to the machine and describes the objectives, design features, system analysis, hardware, software, and possible industrial application for the Monitor System. The Appendices provide details on the system analysis and the start-up procedure for the system.

20592 (UTNL-R—0110, pp 41-44) **Dismantling and removal of glove boxes for plutonium.** Otsuka, Katsuyuki (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01.

In Summaries of environmental safety in nuclear fuel cycles; fiscal 1979 and 1980.

In the plutonium fuel development in Power Reactor and Nuclear Fuel Development Corporation (PNC), the radioactive wastes are classified into those produced routinely and those resulting from the replacement of old equipments. For the management of such wastes, the works done in and after fiscal 1976 are described, such as the dismantling and removal of glove boxes and also liquid waste tanks, including those for the mockup test and the actual operation. The purpose of the mockup test is to reduce the volume of wastes in dismantling by cutting globe boxes into pieces. Around a glove box, first, a "greenhouse" was constructed to prevent the spread of radioactivity. The glove box was cut with a plasma torch by workers within the greenhouse. For future study, there is a problem of the operation with high efficiency.

20593 **(Y/LA—810-Rev.1) Additional testing of DT-14 shipping container.** Crowder, H.E. (Oak Ridge Y-12 Plant, TN (USA)). 30 Jun 1981. Contract AC05-84OS21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010211.

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Data are presented which documents additional testing, both structural and inner containment leak testings, of the DT-14 Fissile Material Shipping Container as requested by the Department of Energy and the Nuclear Regulatory Commission. 18 figures.

20594 **(Y/Sub—80-7733/201) Analytical model of strength loss in filament wound spherical vessels. Final report, October 1, 1981-September 30, 1983.** Leavesley, P.J.; Knight, C.E. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Nov 1983. Contract AC05-84OS21400. 225p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84010213.

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The ability to predict potential strength degradation of a filament wound sphere was developed using an incremental finite element model of the composite during fabrication. The sphere was modeled taking into account the winding/loading pattern and the resulting internal layer boundaries. The thickness profile of the sphere's layers were computed using a thickness profile/pattern simulation program. This thickness profile was used by the mesh generating program to ensure that the elements generated die not cross layer boundaries. The elements used were four noded isoparametric quadrilateral elements and these were collapsed to triangular elements for transitions. The input to the finite element program was prepared by an interface program which combines the mesh generator output with the loading and option control data. The main feature of the finite element program was the incremental construction and loading of the model. Strength degradation definitely occurs when the average fiber layer strain is negative. The negative strain means that all the winding tension has been lost from the layer and the fibers in uncured resin will buckle when they try to support compressive loading. Then when the resin cures the buckled region of fibers are degraded in strength. This model gives a layer-by-layer analysis of the potential strength loss of the composite.

20595 (ZfI-Mitt—69, pp 297-306) **Progress in leak detection methods for underground pipelines and tanks.** Listwan, W. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The present paper deals with new arrangements for the localization of leaks in underground pipelines and tanks by means of radiotracers. Preparation and injection of $CH_3{}^{82}Br$ and $K^{82}Br$ are described.

20596 **Engineering hot-cell windows for radiation protection.** Ferguson, K.R.; Courtney, J.C. (Argonne National Laboratory P.O. Box 2528 Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **45**: 784-785(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

4203 Lasers

REFER ALSO TO CITATION(S) 20527, 20565, 20636

20597 **(AD-A—134917/4) Atomic hydrogen maser investigations of hydrogen atom interactions from 4 k to 12 k. Annual summary report 1 Mar 83-29 Feb 84.** Crampton, S.B. (Williams Coll., Williamstown, MA (USA). Dept. of Physics). 20 Nov 1983. 5p. NTIS, PC A02/MF A01.

Techniques and data developed during previous studies of the ground state hyperfine resonance of hydrogen atoms intermittently adsorbed on molecular hydrogen surfaces are applied to the development of a Very Low Temperature Atomic Hydrogen Maser incorporating a state-selected hydrogen atom beam with thermal speeds near 5 K. Studies are made of adsorption of hydrogen atoms on molecular hydrogen and atomic neon solid surfaces at 4 K to 12 K.

20598 **(DOE/DP/40124—21) Investigation of sol-gel antireflective coatings.** Schmid, A.; Guardalben, M.; Chipp, T. (Rochester Univ., NY (USA). Lab. for Laser Energetics). Mar 1984. Contract AC08-80DP40124. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008381.

Very high power laser systems present material design challenges which often approach the inherent optical survival strength of components. Optical coatings in the UV region suffer from anomalously high absorption and scattering in the deposited layers. The losses caused by these effects are often unacceptable or, in the case of absorption, usually fatal to the absorbing coatings. Unfortunately, no metals exist that have high enough reflectivities in the UV to serve as uncoated mirrors as they normally do in the CO_2 region of the infrared. Adequate multilayer dielectric coatings are therefore critically important for the development and utilization of UV lasers. The same could be said for relfection suppressing antireflective coatings in that wavelength range. Antireflective properties of gradientindex designs have been rediscovered and their potential for resolving UV laser design difficulties has been vigorously tested. These antireflective properties have been attained on glass or fused silica surfaces by chemical surface treatments.

20599 **Self-scanning of a dye laser due to feedback from a $BaTiO_3$ phase-conjugate reflector.** Whitten, W.B.; Ramsey, J.M. (Analytical Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Optics Letters;* **9**: No. 2, 44-46(Feb 1984). Contract W-7405-ENG-26.

Feedback from a self-pumped $BaTiO_3$ phase-conjugate reflector into an untuned cw dye laser produces substantial line narrowing (4—6 GHz) and generates a recurrent wavelength sweep from the rhodamine 6G peak at 618 nm to as far as 644 nm.

20600 **Generation of widely tunable nanosecond pulses in the vibrational infrared by stimulated Raman scattering from the cesium 6s—5d transition.** Harris, A.L.; Brown, J.K.; Berg, M.; Harris, C.B. (Department of Chemistry, University of California at Berkeley, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Optics Letters;* **9**: No. 2, 47-49(Feb 1984). Contract AC03-76SF00098.

The first reported use of a pulsed rhodamine-dye laser to generate widely tunable nanosecond light pulses in the vibrational infrared by stimulated electronic Raman scattering is discussed. Narrow-band pulses of up to 120 μJ were generated from 3450 to 900 cm^{-1} (2.9 to 11.1 μm), and broadband pulses up to 75 μJ were generated from 3390 to 1800 cm^{-1} (2.9 to 5.5 μm) by scattering from the 6x—5d transition in cesium vapor. Cesium dimer effects on tuning-curve structure and efficiency are discussed.

20601 **Generation of tunable picosecond pulses in the vibrational infrared by stimulated electronic Raman scattering of rhodamine-dye-laser pulses from the 6s—5d cesium transition.** Berg, M.; Harris, A.L.; Brown, J.K.; Harris, C.B. (Department of Chemistry, University of California at Berkeley, and the Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Optics Letters;* 9: No. 2, 50-52(Feb 1984). Contract AC03-76SF00098.

The first reported use of a rhodamine-dye laser to generate tunable high-power picosecond pulses in the vibrational infrared is described. By using stimulated electronic Raman scattering from the 6s—5d transition in a superheated cesium vapor, we have shifted 1-psec pulses from an amplified rhodamine-dye laser (568—590 nm) to 3040—2320 cm^{-1} (3.3—4.3 μm). Somewhat longer pulses have been shifted to 1950 cm^{-1} (5.1 μm). Peak infrared energies of 11 μJ, representing a quantum efficiency of 4.6%, were obtained at a 10-Hz repetition rate. Tuning to longer wavelengths with short pulses is limited by nonlinear processes but should be possible by further reductions of cesium dimer effects.

20602 **Ring cavity for a Raman capillary waveguide amplifier.** Kurnit, N.A. (to Dept. of Energy). US Patent Application 6-229,023. 27 Jan 1981. 22p. Contract W-7405-ENG-36.

A regenerative ring amplifier and regenerative ring oscillator are described which function to feed back a portion of the Stokes signal to complete the ring cavity. The ring cavity configuration allows the CO_2 laser pump signal and Stokes signal to copropagate through the Raman capillary waveguide amplifier. A Raman capillary waveguide amplifier is also provided in the return leg of the ring cavity to increase gain without increasing the round trip time. Additionally, the ring cavity can be designed such that the amplified Stokes signal is synchronous with the mode-locked spikes of the incoming CO_2 laser pump signal.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 20130, 20135, 20241, 20242

20603 **(DOE/LC/10886—1555) Finite element investigation of thermo-elastic and thermo-plastic consolidation.** Aboustit, B.L. (Ohio State Univ., Columbus (USA)). Jan 1984. Contract AS20-82LC10886. 139p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84003086.

The transient response of saturated continua due to thermal as well as mechanical loads is investigated in both elastic and plastic ranges. When the two phase saturated media are subjected to thermomechanical loading, the energy equation is coupled with the mass flow and solid deformation equations resulting in the initial boundary value problem of thermal consolidation. The solid behavior may be assumed to be either elastic or elastoplastic leading to the associated theories of thermoelastic and thermoelastoplastic consolidation. The governing equations for the quasi-static infinitesimal theory of thermoelastic consolidation are developed by using the theory of mixtures. An equivalent variational principle is developed along with associated finite element formulations. Two isoparametric elements of the composite type are employed for the spatial discretization. The formulation is extended to the plastic ranges by modeling the solid phase as an elastic work hardening material with an associated flow rule. An incremental iterative scheme is developed to solve this nonlinear transient problem. Several special purpose computer codes are developed for evaluating the isothermal, thermal, elastic and elastoplastic plane strain consolidation responses. These codes have been evaluated against limiting cases available in the literature. The effects of temporal and spatial interpolation schemes are investigated for one-dimensional thermoelastic consolidation problems. An application dealing with a plane strain underground coal gasification problem is also presented.

20604 **(DOE/PC/50796—T4) Diffusion of gases in porous solids - simulations and measurements. Sixth quarterly report, October 16, 1983-January 15, 1984.** Evans, J.W. (California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). 1984. Contract FG22-82PC50796. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008378.

An inprovement is reported in the simulation of the diffusion of gas molecules in a porous solid. A new algorithm was tested that relies on starting molecules at random points within the solid rather than at one face of the solid. The treatment is simialr to that of the random walk. Mean free paths and tortuosities are computed. (LEW)

20605 **(FEI—1317) Study on the surface boiling beginning in water forced flow in an annular space.** Remizov, O.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700774.

Investigation of the surface boiling beginning as a function of pressure, underheating up to temperature saturation, and water flow rate in an annular channel has been carried out. Investigation was performed at absolute . pressure of 1.47-2.94 NPa and linear flow rates of 1-6 m/s. A formula of a heat flux for the beginning of boiling as a function of pressure is proposed on the base of experimental data obtained. It has been established experimentally, that the surface boiling beginning and a transition region from surface boiling to nucleate one is dependent on channel geometry but for the most part is condition ditiored by physical parameters and water flow rate.

20606 **(K-L—6215) Flow curves for 21 multi-orifice reference plates.** Selby, T.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Aug 1968. Contract AC05-84OT21400. 48p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84010038.

This report consists of a volume flow versus differential pressure curve for each of 21 multi-orifice reference plates. These curves are for the standard operating conditions of 70°F and 14.7 psia inlet pressure. Correction factors for temperatures and pressures other than standard are also provided. Standard volume flows can be determined at operating conditions from these curves and the correction factors with a precision of +- 0.5%.

20607 **(LA-UR—84-120) Principles and prospects for micro heat pipes.** Cotter, T.P. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-840578—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006035.

From 5. international heat pipe conference; Tsukuba, Ibaraki, Japan (14 May 1984).

The fabrication and purpose of very small wickless heat pipes are discussed. A theoretical analysis of their performance characteristics shows that they have nearly the heat transport capability expected by scaling down from conventional heat pipes. They appear attractive for applications calling for close temperature control, but having only modest cooling requirements.

4205 Materials Testing

REFER ALSO TO CITATION(S) 20437, 20506

20608 **(CONF-840386—3) Neutron radiography at the NRAD facility.** McClellan, G.C.; Richards, W.J. (Argonne National Lab., Idaho Falls, ID (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009182.

From 9. US TRIGA owner-user conference; Anaheim, CA, USA (12 Mar 1984).

The NRAD facility uses a 150 kW TRIGA reactor as a source of neutrons and is integrated with a hot cell such that highly radioactive specimens can be radiographed without removing them from the hot cell environment. A second beam tube is located in a

separate shielded addition to HFEF and permits neutron radiography of irradiated or unirradiated specimens without subjecting them to the alpha-contaminated hot cell environment. Both beams are optimized for neutron radiography of highly radioactive nuclear fuels. Techniques for using these facilities are described. Advantages include: the ability to perform thermal and epithermal neutron radiography on specimens either inside or outside the hot cell, lack of competition for the use of the reactor, versatility of facility design, and the addition of neutron tomography. (LEW)

20609 (ZfI-Mitt—69, pp 247-266) **Modernized versions of mobile non-destructive testing laboratories.** Avramov, D. (Central Inst. on Mechanical Engineering, Sofia (Bulgaria)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Some light and medium trucks have been equipped with modern apparatuses to serve as mobile laboratories for non-destructive testing of welded joints, metal constructions, tanks, pipelines, and other objects manufactured, assembled, and operated in workshops or under field conditions. Technical specifications and the lists of fits and accessories are given for each truck.

4207 Vacuum Engineering

20610 **Pumping of inert gases by electron-impact ionization sources and associated memory effects.** Willis, R.D.; Allman, S.L.; Chen, C.H.; Alton, G.D.; Hurst, G.S. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **2**: No. 1, 57-60(Jan 1984). Contract W-7405-ENG-26.

Radioactive ^{85}Kr was used in a closed volume under moderate vacuum to investigate mechanisms by which inert gas atoms are pumped in an electron-impact ionization source of a simple diode design. Results are consistent with a mechanism involving the conversion of inert gas ions into energetic neutrals at the cathode followed by reflection and trapping of some of the neutral atoms in nearby surfaces. We discuss the possibility that the source pumping speed is enhanced due to burial of the trapped neutrals by material released in low-energy sputtering processes. The implications of these results for reducing memory effects in UHV mass spectrometer systems are discussed.

20611 **Cobalt—samarium magnets sealed for high vacuum applications.** Delmore, J.E. (Idaho National Engineering Laboratory, Idaho Falls, Idaho 83401). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **2**: No. 1, 73-74(Jan 1984).

A carefully packaged Co—Sm magnet is described for use in an electron capture ion source.

20612 **Vacuum chamber for edgeless studies of gas—metal reactions.** Patterson, R.G.; Musket, R.G. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **2**: No. 1, 82-84(Jan 1984). Contract W-7405-ENG-48.

The concept, design, construction, and operation of a high vacuum reaction chamber are described. This chamber eliminates specimen edge effects, permits studies of the quantitative kinetics of gases reacting with the surfaces of disklike specimens, and is well suited for evaluation of various schemes (e.g., coatings, ion implantations) designed to protect practical surfaces from the gases. Operation of the chamber has been demonstrated for the hydriding of depleted uranium in 76 Torr of hydrogen at 130 °C.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 20517, 20518, 20607

20613 **(DOE/NBM—4001796) Method that combines internal state estimation and external network modeling.** Monticelli, A.; Wu, F.F. (California Univ., Berkeley (USA)). 1983. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84001796.

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A method that combines internal state estimation and external network modeling is developed. The external system is represented by an unreduced load flow model. One state estimation covering both the internal system and the external system is used. The external system operating data on power injections and bus voltages are entered as pseudo-measurements. At each iteration the set of active pseudo-measurements are selected to conform with the specified variables in a load flow program. Because such a set of non-redundant measurements is used, the internal state estimation is not affected by the external system pseudo-measurements. External generation MVAR and controlled bus voltage limits are enforced. A technique is developed to make a pseudo-measurement dormant. Using the dormant-measurement technique, it is possible to maintain the same external system state estimation formulation while the PV-PQ switching takes place from iteration to iteration. The method can easily be implemented by modifying an existing state estimation program. It has been implemented in a fast model-decoupled estimation program. Because of the dormant measurement technique, the constant gain matrix evaluated at flat voltage is used in every iteration. The method has been tested on the IEEE 14-bus, 30-bus, and Brazilian 66-bus systems. Excellent results are obtained. The number of iterations for the method to converge is usually the same as the regular state estimation runs. Thus the method presented here achieves simultaneously the internal state estimation and the external network modeling without adversely affecting the internal state estimation.

20614 **(LA—9956-MS-Pt.1) Losses in magnetic flux compression generators. Part 1. Linear diffusion.** Fowler, C.M. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 62p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84010243.

This is the first of three monographs devoted to a detailed analysis of magnetic flux losses in explosive-driven flux compression generators. Magnetic field diffusion into generator conductors can lead to substantial losses. A study of linear diffusion is therefore the major subject treated in this report. Diffusion analysis is considerably complicated by the presence of moving conductors and the compression of magnetic flux. Consequently the text is treated in a tutorial fashion. This is particularly true in the earlier parts of the report where formulation of basic equations, various conservation laws, and problem solutions are treated in considerable detail. A point of departure from earlier treatments of the subject is the addition of external circuits to the generators. It is shown that the influence of these circuits enters into the boundary conditions for the diffusion equations. A number of new analytic solutions are obtained for various external circuits.

20615 **(ORNL/Sub—81-61623/1) Development of a solid-state circuit breaker concept.** Garzon, R. (Brown Boveri Electric, Inc., Colmar, PA (USA)). Dec 1983. Contract W-7405-ENG-26. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009110.

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There has been a need for a reliable and economical, high-voltage, high-power circuit breaker that is capable of reducing the arc energy during fault-current interruption, and thus, reducing contact erosion and extending the required maintenance of the contacts. A design concept using solid-state diodes in combination with synchronously operated mechanical switches offers one possibility of meeting this need. This report describes the proposed concept and the results of the experimental program that was conducted to evaluate the practical feasibility of such a circuit breaker.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 20330

20616 **(BMFT-FB-T—83-229) Development of adjustable low power vaporizing burners with high energy efficiency.** Mallog, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1983. 134p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750726.

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The investigations on the design and the development of a new adjustable vaporizing domestic burner has been terminated. In the future low power burners are needed; the objective of the project is to develop an adjustable low power oil-burner in the range of 1,5-20 kW with high energy efficiency. Vaporizing Oil burner with high internal flue gas recirculation resulted in a stable blue flame in the range between 3,5-40 kW, burnout over 99,8%. The burner concept can satisfy the requirements of domestic heating only within certain limits.

20617 **(CONF-840302—3) Direct coal combustion in gas turbines.** Horner, M.W. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). 1984. Contract AC21-83MC20315. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009184.

From 11. annual energy technology conference and exposition; Washington, DC, USA (19 Mar 1984).

Recent developments in the beneficiation, cleaning, fine grinding, and slurry preparation for coal water mixture fuels have prompted renewed interest in the direct combustion of coal in gas turbines. Advances in gas turbine technology have been identified which will improve the opportunities for success with coal fuels. The next step in the march toward direct coal combustion in gas turbines should be the initiation of parallel development programs in fuel preparation and turbomachinery. There is sufficient uncertainty and opportunity in both areas so that technical breakthroughs and more detailed knowledge of basic phenomena in cleaning, combustion, corrosion, erosion and deposition could provide the key to economically and technically competitive systems. While the coal/water mixture fuel form has obvious advantages for transportation, storage, and delivery, the dry pulverized coal option cannot be put aside totally. The dry form is somewhat difficult to handle but does avoid the expense of additives for stability and viscosity control, which can be expensive. The most urgent development need in fuel preparation is to prove technology which can provide a low-sulfur, low-ash coal at competitive cost. Low-cost additives must also be developed for the coal/water mixture fuel form. The need for gas turbine technology development centers in two major areas: combustion and turbine blading tolerance to corrosion, erosion, and ash deposition. The most direct path to the development of these highly related areas of technology will be to conduct small-scale turbine testing for exploratory research and development. It is proposed that the best technologies available be applied to the first test system and that carefully planned, instrumented tests be conducted to evaluate the components' performance. Only modifications which are indicated from test analysis would be made for further testing and evaluation.

20618 **(GA-A—17426) Comparative results of multifuels fluidized bed combustion testing in both bubbling and circulating bed modes.** Rickman, W.S. (GA Technologies, Inc., San Diego, CA (USA)). 1984. Contract AT03-84SF11964. 9p. (CONF-840302—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009138.

From 11. annual energy technology conference and exposition; Washington, DC, USA (19 Mar 1984).

GA Technologies Inc. has completed more than 7500 hr of fluidized bed combustion research on a wide variety of fuels, including bituminous coal and coal refuse, petroleum coke, and radioactive and industrial wastes. These tests have been sponsored by United States and foreign government agencies; electric utilities, a number of industrial firms, including chemical, oil, and primary metals companies; and a boiler supplier. Testing has been conducted in GA's 2 mm Btu/hr pilot plant in San Diego, California. This modern facility is operated either as a bubbling fluidized bed combustor or as an advanced circulating bed combustor. It is highly instrumented with a computer-based control and data acquisition system that allows accurate determination of process performance. All tests were structured to determine the most economical operating conditions for maximizing combustion efficiency while minimizing emissions such as SO_2, CO, NO/sub x/, and HCl. Results to date conclusively indicate inherent advantages to the circulating bed mode of combustion in all of these performance criteria. These advantages are mostly due to the increased turbulence, mixing, recycle, and throughput in the circulating bed as well as to the mechanical difficulties associated with operation of a bubbling fluidized bed.

20619 **(KFK—3551) Power determination in the charge of coreless induction furnaces by measuring electrical values in the furnace and generator circuits.** Schuelken, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Aug 1983. 204p. (In German). NTIS (US Sales Only), MF A01. Order Number DE84750728.

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This report theoretically discusses selected subjects concerning the lay out, operation, and control of coreless induction fornace facilities. Methods to determine power consumption in the crucible from measured electrical values in the generator and furnace circuits are described. Three specific subjects are treated: the furnace circuit, the generator valve, and the oscillator circuit.

20620 **(PB—84-153212) Pollutant control techniques for package boilers: hardware modifications and alternate fuels. Final report Jun 74-Mar 78.** Cichanowicz, J.E.; Heap, M.P.; McMillan, R.E.; Zoldak, F.D. (Energy and Environmental Research Corp., Irvine, CA (USA)). Feb 1984. 235p. NTIS, PC A11/MF A01.

The report gives results of investigations of four ways to control nitrogen oxide (NOx) emissions from package boilers (both field operating boilers and boiler simulators): (1) variations in combustor operating procedure; (2) combustion modification (flue gas recirculation and staged combustion); (3) use of an alternate fuel, methanol; and (4) burner design optimization. Comparative tests were conducted in a firetube boiler. Reduced excess-air firing was the only NOx control that both reduced emissions and increased thermal efficiency. Flue gas recirculation and staged combustion had negligible effects on boiler operating efficiency. Conversion to methanol results in a considerable decrease in thermal efficiency because of the water vapor's increasing the enthalpy of the flue gas.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 21153

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 19982, 19983

4250 Power Cycles

REFER ALSO TO CITATION(S) 19976

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

20621 **(FERMILAB/TM—1239) Estimate of the longitudinal and transverse impedances for the superconducting super collider.** Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jan 1984. Contract AC02-76CH03000. 6p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009404.

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We try to estimate the longitudinal impedance per harmonic Z/sub L//n as well as the transverse impedance Z/sub T/ for the 20 TeV Superconducting Super Collider (SSC). Effects due to space charge, wall resistivity, bellows, monitor plates, synchrotron radiation are considered. The resulting Z/sub L//n and Z/sub T/ are plotted. Such a knowledge of Z/sub L//n and Z/sub T/ is necessary in computing the limits of many types of instabilities for the bunched beam. To be more specific, in our estimation, we consider the special case of an injection energy of 1 TeV and assume a maximum field of 5 Tesla in the SSC dipoles. In some cases, we also assume a 60° FODO cell structure consisting of 4 dipoles and 2 quadrupoles each with 2 long straight sections. The beampipe radius and beam radius are chosen as b = 1.0 in. and a = 0.05 cm respectively. Totally, the storage ring consists of 364 cells and has a mean radius of R = 17.38 km. Our results show that when monitor plates matched at both ends (such as the ones used in the Tevatron) are used, their effects dominate both Z/sub L//n and Z/sub T. 7 references, 5 figures.

20622 **(INS-NUMA—31) Workshop report of measurement in NUMATRON project and data processing system.** (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jan 1982. 102p. (In Japanese). (CONF-8107123—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780113.

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

The papers presented were entered into the data base separately. (WHK)

20623 **(LBL—17050) Effect of manufacturing errors on field quality of the LBL SSC dipoles.** Meuser, R.B. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 10p. (CONF-831264—13). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009224.

From Workshop on accelerator physics issues for a superconducting super collider; Ann Arbor, MI, USA (12 Dec 1983).

A method is developed for determining the field aberrations resulting from specific kinds of manufacturing errors. This method is applied to the 40-mm i.d. dipoles under consideration at LBL, and also to similar ones with 30 and 50 mm i.d. The method is also applied to the CBA and Doubler/Saver magnets and the results compared with the measurements. The results obtained by this method are also compared with those obtained by assigning identical errors to the positions of the edges of all the coil sectors.

4302 Beam Dynamics, Field Calculations, And Ion Optics

20624 **(CONF-831264—12) Spiral kicker for the beam abort system.** Martin, R.L. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007267.

From Workshop on accelerator physics issues for a superconducting super collider; Ann Arbor, MI, USA (12 Dec 1983).

A brief study was carried out to determine the feasibility of a special kicker to produce a damped spiral beam at the beam dump for the beam abort system. There appears to be no problem with realizing this concept at a reasonably low cost.

20625 **(DOE/ER/05001—T1) High energy channeling and its applications. Progress report, November 1, 1982-October 30, 1983.** Gibson, W.M.; Sun, C.R. (State Univ. of New York, Albany (USA). Dept. of Physics). Nov 1983. Contract AC02-78ER05001. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007251.

Results on the steering of the particles at Fermilab energies through bent single silicon crystals will be described. Study of the data taken at 8.4 GeV at Dubna has lead to the evaluation of normal dechanneling in silicon crystal. Detail study of channeling radiation at 2, 4, 6 and 10 GeV positrons has resolved previously existed differences between theory and experiment. Angular distributions studies are in progress. Radiation damage on Si crystals used in high energy channeling experiment showed remarkable promise. 13 references.

20626 **(EGG—10282-2012) Estimation of space charge and emittance growth effects in a drift region.** Sawyer, C.; Norris, N. (EG and G, Inc., Goleta, CA (USA). Energy Measurements Group). Mar 1984. Contract AC08-83NV10282. 11p. (CONF-840529—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007584.

From Linear accelerator conference; Darmstadt-Seeheim, F.R. Germany (7 May 1984).

Designing a beam transport system for the EG and G/EM electron linac with the matrix multiplication computer code, TRANSPORT, leaves unresolved questions as to the effects of space charge and emittance growth on beam radius, as the code assumes constant emittance and no space charge. ZFIELD, a trajectory computer code for a linac beam, has been written as a design aid. It includes space charge, plots the emittance ellipse at axial values, and plots beam radius. Comparing ZFIELD and TRANSPORT in drift regions, significant differences in beam radius predictions are found in the 2-MeV region for currents above 200 A and above 400 A in the 4-MeV region. Beam envelope growth for beams with different emittance is compared using ZFIELD. The effect of space charge on emittance growth is shown graphically. 6 references, 4 figures, 1 table.

20627 **(EGG—10282-2013) Computer optimization of a linac injector trajectory.** Sawyer, C.; Detch, J.L. Jr. (EG and G, Inc., Goleta, CA (USA). Energy Measurements Group). 1984. Contract AC03-76SF00515. 13p. (CONF-840529—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84005034.

From Linear accelerator conference; Darmstadt-Seeheim, F.R. Germany (7 May 1984).

One can determine a computer prediction of the beam radius as a function of axial distance for a linac beam by providing a set of inputs to the computer code, ZFIELD. The trajectory may be improved by varying the magnet current values in the code, but repeated trails may still not attain the best trajectory. Starting with a set of points containing the desired trajectory, one may work the problem backwards and obtain the necessary magnet currents required by the trajectory. In the examples given, a portion of the trajectory is chosen to be parabolic. The trajectory information is used with a differential equation involving beam radius and its derivatives to yield the magnetic field as a function of axial position. Matrix methods are used to obtain the magnet currents from the magnetic field. 4 references, 6 figures.

20628 **(FERMILAB/TM—1241) Design study of the TeV I pulsed septum magnet.** Oleksiuk, L.W. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1 Feb 1984. Contract AC02-76CH03000. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009408.

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Magnetic field calculations have been performed using the POISSON code to assist in the design of a pulsed septum magnet for beam manipulation in the TeV I antiproton accumulator/debuncher system. Magnet current distributions are obtained from eddy current considerations relative to a pulsed half-sine wave of 1200 Hz. Magnet end effects are not considered here.

20629 **(FERMILAB/TM—1246) How much random sextupole field can we have in the presence of beam-beam interactions.** Ohnuma, S. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1984. Contract AC02-76CH03000. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009867.

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During the workshop, two estimates of the random sextupole components in the SSC dipoles have been presented, one from Berkeley and the other from Brookhaven. The resulting resonance width 2 ϵ/sub G/ is calculated for four third-interger resonances using the lattice designed by the Berkeley group. In order to compare the width with the results from CERN Sp anti p S beam studies we use the CERN-style emittance corresponding to 2 σ (86.5%) instead of $\sqrt{6}\,\sigma$ (95%).

20630 (FERMILAB/TM—1247) Width of nonlinear resonance. Ohnuma, S. (Fermi National Accelerator Lab., Batavia, IL (USA)). Mar 1984. Contract AC02-76CH03000. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009862.

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Two approximations are made, one essential and the other not so essential but convenient to keep the analytical treatment manageable: (1) Only one nonlinear resonance is considered at a time so that the treatment is best suited when the tune is close to one resonance only. To improve this approximation, one must go to the next order which involves a canonical transformation of dynamical variables. Analytical treatment of more than one resonance is not possible for general cases. (2) In the formalism using the action-angle variables, the Hamiltonian can have terms which are independent of the angle variables. These terms are called phase-independent terms or shear terms. The tune is then a function of the oscillation amplitudes. In the lowest-order treatment, the (4N)-pole components but not the (4N + 2)-pole components contribute to this dependence. In deriving the resonance width analytically, one ignores these terms in the Hamiltonian for the sake of simplicity. If these are retained, one needs at least three extra parameters and the analytical treatment becomes rather unwieldy.

20631 (IFVE-OI—82-179) On nonlinearity in parametric coupling of particle oscillations in ion linacs. Budanov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700783.

The nonlinearity of the dependence of the accelerating field defocusing effect on longitudinal oscillation phase is studied. In the framework of smooth approximation the influence of this nonlinearity on parametric action of longitudinal oscillations on transverse ones is considered. Analytical and numerical estimates for the increments of oscillation growth under parametric resonance are obtained.

20632 (JINR—R-13-82-780) Use of high-frequency field for focusing particles in a proton microprobe. Dymnikov, A.D.; Osetinskij, G.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700790.

A possibility of designing a HF microprobe for proton beam with a few MeV energy is considered. Values of am-- plitudes and frequency of HF field, limitations to bunches sizes and optical characteristics of ideal system for forming the proton beams of micron sizes are given.

20633 (LA—9949-MS) Staged approach for LAMPF II. Colton, E.P. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010242.

A staged accelerator design is presented for the LAMPF II project. Two equal-sized rapid-cycling synchrotrons are utilized. A booster preaccelerator accelerates protons to 5.5 GeV/c, whereupon they are further accelerated to 32.978 GeV/c in the second accelerator. Transition is not crossed in the process. The current requirement of 100 μA is met by the design. Polarized proton acceleration is also discussed. 9 references, 5 figures, 7 tables.

20634 (LBL—17253) Single bunch instabilities in an SSC. Ruth, R.D. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 6p. (CONF-831264—10). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009217.

From Workshop on accelerator physics issues for a superconducting super collider; Ann Arbor, MI, USA (12 Dec 1983).

In this note coherent instability thresholds are estimated for the SSC and discuss some of the subsequent design restrictions. The various instabilities are set out in a block diagram with the essential features of each. The assumption is made that long wavelength coupled bunch effects can be cured effectively by a feedback system (both longitudinal and transverse) and that the impedance of the feedback system is such as to cancel that of the environment (at low frequency). Alternatively, the long wake field is assumed to be exactly canceled, on the average, by a feedback wake field. This leaves only single bunch effects. Thresholds for fast-blowup are discussed both in the longitudinal and transverse and the transverse mode coupling instability more familiar in electron/positron storage rings is covered. The impedances considered are a broadband impedance and the resistive wall impedance.

20635 (BNL-tr—1027) Acceleration regime of an accelerating complex of heavy ions in a heavy-ion synchrotron. Beloshitskii, P.F.; Kazarinov, N.Yu.; Perel'shtein, Z.A. (Brookhaven National Lab., Upton, NY (USA); Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. Contract AC02-76CH00016. Translation of P9-83-604, Communication of the Joint Institute for Nuclear Research, Dubna, 1983. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009548.

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The heavy-ion synchrotron (HIS) is designed to accelerate the ions of all the elements of the periodic table up to energies of 50 to 800 MeV/nucl. A slow extraction of the ion beam for conducting physical experiments is provided in the HIS, and also a rapid extraction for transfer of the beam to the JINR synchrophasotron. The regimes corresponding to the acceleration of light nuclei and uranium in cases of slow and rapid extraction are examined in the present paper. The longitudinal movement of the ions is examined and the operating regimes of the electronic and magnetic systems in the HIS, which assure minimal losses of the particles during acceleration, are determined, taking into account the real technical possibilities of these systems. The demands imposed on the stability of the magnetic field and the radio frequency and the allowances for harmonic and noise perturbations of the magnetic field, amplitudes and frequencies of the accelerating voltage are established. 8 references, 7 figures, 2 tables.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 20676, 21221, 21413

20636 (AD-A—134270/8) Wave-particle interactions on relativistic electron beams. Final report. Bernstein, I.B.; Hirshfield, J.L. (Yale Univ., New Haven, CT (USA)). 20 Oct 1983. 104p. NTIS, PC A06/MF A01.

A summary of research performed under subject contract is given. The work is in the main concerned with the theory, both linear and non-linear, for the gain of a free electron laser (FEL) in a strong axial magnetic field. Both wiggler and wiggler-free configuration are considered. An experimental study is described of the transition from helical to non-helical orbits in a wiggler with a guide field. THe exact magnetic field of a filimentary bifilar current-carrying helix is given. The degradation in gain of a FEL without axial guide field due to velocity spread is given. Twelve published papers are appended.

20637 (AD-A—134694/9) External injection into a high current modified betatron accelerator. Memorandum report. Mako, F.; Manheimer, W.; Kapetanakos, C.A.; Chernin, D.; Sandel, F. (Naval Research Lab., Washington, DC (USA)). 8 Nov 1983. 15p. (NRL-MR—5196). NTIS, PC A02/MF A01.

By axially tapering the current density at each end of an axial pinch a scheme is developed for injecting electrons across magnetic field lines into a modified betatron accelerator. This scheme produces only a minimal perturbation to the circulating electron beam. The axial pinch provides beam equilibrium in the transverse field and the tapering reduces the non-adiabatic growth of the perpendicular particle velocity from 0.5 c to .05 c for the parameters of the NRL modified betatron.

20638 (BNL—34314) Vacuum ring exit chamber temperatures due to wiggler beam heating. Sharma, S.; Ulc, S. (Brookhaven National Lab., Upton, NY (USA)). Jan 1984. Contract AC02-76CH00016. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010220.

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A study was made to determine the effects of a shift in the electron orbital plane and resulting displacement of the wiggler photon beam striking the inner surface of the existing vacuum chamber outer wall. The wiggler beam/vacuum chamber geometry is shown. 7 figures.

20639 **(EFI—566(53)-82) Monochromotization of coherent bremsstrahlung spectra using time selection method.** Avakyan, R.O.; Avetisyan, A.Eh.; Zapol'skij, N.A.; Mirzoyan, R.M.; Simonyan, Kh.A.; Taroyan, S.P.; Tumanyan, A.R. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700781.

A new method of monochromatization of coherent bremsstrahlung energy spectra, taking into account the specific features of γ-beam extraction system of the Erevan synchrotron, is described. The effects of the beam extraction moment (electron time selection) on the bremsstrahlung energy spectra are studied. The spectral characteristics of bremsstrahlung of electrons with energy E_0=3.9 GeV in diamond monocrystal have been experimentally measured. The experimental data analysis shows that the discovered changes in coherent effects in bremsstrahlung spectra are connected in the main with different values of angular spread for electrons inciding on crystal radiator at different moments of beam extraction. The conclusion is made that the described method can be used for one-line studies of elementary particle photoproduction as well as for determination of accelerated electron beam angular and energy characteristics.

20640 **(FERMILAB/TM—1238) Fermilab 200 MeV linac control system hardware.** Shea, M.F. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jan 1984. Contract AC02-76CH03000. 82p. NTIS, PC A05; 3; GPO Dep. Order Number DE84009412.

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This report is a description of the present Linac distributed control system that replaces the original Xerox computer and interface electronics with a network of 68000-based stations. In addition to replacing the obsolete Xerox equipment, goals set for the new system were to retain the fast response and interactive nature of the original system, to improve reliability, to ease maintenance, and to provide 15 Hz monitoring of all Linac parameters. Our previous experience with microcomputer installations showed that small, stand-alone control systems are rather straightforward to implement and have been proven to be reliable in operation, even in the severe environment of the 750-keV preaccelerator. The overall design of the Linac system incorporates the concept of many relatively small, stand-alone control systems networked together using an intercomputer communication network. Each station retains its local control system character but takes advantage of the network to allow an operator to interact with the entire Linac from any local console. At the same time, a link to the central computer system allows Host computers to also access parameters in the Linac.

20641 **(FERMILAB/TM—1240) EPICS system: RSX implementation issues.** Lahey, T.E.; Bartlett, J.F.; Bobbitt, J.S.; Kramper, B.J.; MacKinnon, B.A.; West, R.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1984. Contract AC02-76CH03000. 7p. (CONF-8310182—15). NTIS, PC A02; 1; GPO Dep. Order Number DE84009403.

From US fall DECUS symposium; Las Vegas, NV, USA (24 Oct 1983).

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This paper presents implementation details of the Experimental Physics Interactive Control System (EPICS). EPICS is used to control accelerated particle beams for high-energy physics experiments at the Fermi National Accelerator Laboratory. The topics discussed are: interprocessor communication, support of beamline terminals and devices, resource management, mapping, various problems, some solutions to the problems, performance measurement, and modifications and extensions to RSX-11M. This paper is the third of three related papers on the EPICS system. The other two cover (1) the system overview and (2) the system structure and user interface.

20642 **(FERMILAB/TM—1242) Costs to build Fermilab in 1984 dollars.** Jordan, N.G.; Livdahl, P.V. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1984. Contract AC02-76CH03000. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009407.

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It is of current interest to examine the costs incurred to date to build Fermi National Accelerator Laboratory and to determine what those costs are when stated in FY 1984 constant dollars. The appended tables are in support of this exercise and are based on all costs for Equipment items (reduced by obsolescence) and all Plant Projects which have been appropriated through FY 1984. Also included are non-plant costs which are required to complete the Energy Saver, Tevatron I and II projects (i.e., Equipment and R and D in support of Construction). This study makes the assumption that all funding through FY 1984 will have been costed by the end of FY 1986. Those costs incurred in FY 1985 and FY 1986 have been deflated to FY 1984 dollars. See Appendix A for the DOE inflation factors used in the conversion to FY 1984 dollars. The costs are identified in three categories. The Accelerator Facilities include all accelerator components, the buildings which enclose them and utilities which support them. The Experimental Facilities include all beam lines, enclosures, utilities and experimental equipment which are usable in current experimental programs. The Support Facilities include lab and office space, shops, assembly facilities, roads, grounds and the utilities which do not specifically support the Accelerator or Experimental Facilities, etc.

20643 **(FERMILAB/TM—1243) EPICS system: system structure and user interface.** West, R.E.; Bartlett, J.F.; Bobbitt, J.S.; Lahey, T.E.; Kramper, B.J.; MacKinnon, B.A. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1984. Contract AC02-76CH03000. 7p. (CONF-8310182—14). NTIS, PC A02; 3; GPO Dep. Order Number DE84009406.

From US fall DECUS symposium; Las Vegas, NV, USA (24 Oct 1983).

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This paper present the user's view of and the general organization of the EPICS control system at Fermilab. Various subsystems of the EPICS control system are discussed. These include the user command language, software protection, the device database, remote computer interfaces, and several application utilities. This paper is related to two other papers on EPICS: an overview paper and a detailed implementation paper.

20644 **(FERMILAB/TM—1244) EPICS system: an overview.** Bartlett, J.F.; Bobbitt, J.S.; Kramper, B.J.; Lahey, T.E.; MacKinnon, B.A.; West, R.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1984. Contract AC02-76CH03000. 7p. (CONF-8310182—13). NTIS, PC A02; 3; GPO Dep. Order Number DE84009411.

From US fall DECUS symposium; Las Vegas, NV, USA (24 Oct 1983).

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This paper presents an overview of the EPICS control system at FERMILAB. EPICS is a distributed, multi-user, interactive system for the control and monitoring of particle beamlines at a high-energy experimental physics laboratory. The overview discusses the operating environment of the control system, the requirements which determined the design decisions, the hardware and software configurations, and plans for the future growth and enhancement of the present system. This paper is the first of three related papers on the EPICS system. The other two cover (1) the system structure and user interface and (2) RSX implementation issues.

20645 **(IFVE-OEF—82-197) Detectors for proton beam intensity measurements in a wide range.** Dyshkant, A.S.; Sulyaev, R.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700782.

The constructions, characteristics and absolute callibrations of universal detectors designed for measurement of beam intensity in the range from 10^6 up to 10^9 proton/s in the mode of ionization chambers are described. In the ionization mode relative measurement error is +-3%. Above 10^9 proton/s they operate on electron emission from a thin metal foil in the mode of selection of high energy component, which ensures a comparatively higher accuracy of measurements, longterm stability of measurements, uniform zone characteristics. The contribution of the detector into the device obtained measurement errors is evaluated by the authors as 0.5 %.

20646 **(INS-J—165) Development of heavy-ion beams at the INS 176-cm SF cyclotron.** Sato, Kenji; Ohshiro, Yukimitsu; Tanabe, Tetsumi; Sakurada, Yuzo; Yamazaki, Tsutomu. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1982. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700784.

Heavy-ion beams at the INS SF cyclotron have been developed since the first beam was obtained in 1974. Multiply-charged heavy ions of gaseous material lighter than Ne have been successfully accelerated. An internal ion source for solid material has been made and high-intensity beams of sup(6,7)Li^{3+} have been obtained. A pulsed arc power supply of the current-regulator type was constructed by using a tetrode. Two models of the PIG source of the self-heated cold-cathode type have been made and one of them is now in use. Some of the cyclotron components were also improved for efficient use of heavy-ion beams.

20647 (INS-NUMA—29, pp 68-76) **Measurement of neutron production by 500 MeV proton beam.** Hirayama, Hideo; Ban, Shuichi (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

Measurement of high energy neutrons is difficult, because the cross section data are scarce, the cross section at high energy is usually small, and the monoenergetic neutrons are hardly obtained. At the National Laboratory for High Energy Physics (KEK), various threshold detectors have been used for high energy neutron measurement. A carbon detector is a standard detector for high energy neutrons, since the cross section of the C^{12} (n, 2n) C^{11} reaction is almost constant at higher energy than 20 MeV, and the data have been well known. The half-life of the product (C^{11}) is about 20 min, and other activities with longer half-life than 1 min are restricted to Be^7 and C^{11}. As a carbon detector, a plastic scintillator is used, and the neutron spectra observed at the Booster Beam Dump Room of KEK are presented. The results of measurements were compared with the calculated results using a Monte Carlo code made at KEK. Agreement between both results was good.

20648 (INS-NUMA—29, pp 77-82) **Outline of JAERI 20 MV tandem accelerator and a plan of neutron measurment.** Yamauchi, Yoshimaro (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

A 20 MV tandem accelerator was installed at the Japan Atomic Energy Research Institute (JAERI). This accelerator is a multi-purpose machine, and can be used for neutron production. Experiments on the elastic and the inelastic scattering of neutrons are considered. The neutron yield by the D (d, n) reaction with this accelerator is about 10^9 n/sec.sr. A TOF system is equipped to measure neutron spectra. A large size neutron detector was designed and made for trial. The detector is a large NE-213 scintillator with two photo-multipliers. A special circuit was designed to reduce the time dependence of signals due to detection position in the detector. The time resolution is about 850 psec. The n-gamma discrimination characteristics of the detector were good enough for the practical use. As an example, inelastic scattering spectra of S^{32} are presented.

20649 (INS-NUMA—31, pp 3-9) **OLDASS: On-line data acquisition system at SF cyclotron.** Omata, Kazuo; Yasue, Masaharu; Hamagaki, Hideki (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8107123—).

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

The on-line data acquisition system in the Institute for Nuclear Study, the University of Tokyo, is composed of 2 systems of Fujitsu mini-computer PFU-400 for data processing at the high energy synchrotron and one system of that computer for low energy cyclotron as terminals, the host computer being M 180 II AD of the same company. This system has been developed to have the features of being the on-line system capable of following the improvement of host computer performance, being capable of developing the on-line programmes of other experimenting groups in parallel with batch jobs or the operation of the on-line system, and capable of developing programmes using FORTRAN. The result of about 220 KB/s was obtained for the data transfer rate between the programmes of the host computer and terminals, and this fulfilled the aimed performance. The terminal system on the low energy side is provided with an ADC interface and a display interface specified particularly in addition to the miniature computer PFU400 and standard I/O devices of the manufacture. The accumulating type graphic display of the I/O devices can be switched to be connected to the host computer, and immediately displays the results transferred to the host computer and analyzed. Hard copy is also available. The above hardware and software are explained. The on-line system insures 80 K bytes of the total memory of 224 K bytes for data area.

20650 (INS-NUMA—31, pp 10-17) **Present status of on-line data acquisition system for electron synchrotron in Institute for Nuclear Study.** Ishii, Takanobu (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8107123—).

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

Generally, in the data acquisition in high energy experiment, it is inevitable to use a computer on on-line, real-time basis. The reason is as follows: a large amount of data per event, necessity for taking various types of data in every event, repeating is impossible due to low event rate in general high energy experiment, therefore requirement of taking data by monitoring the progress, necessity of feedback from the computer to measuring instruments, etc. Next, considering the compatibility between research laboratories and universities, unified standard is absolutely necessary, and the CAMAC system is employed. The on-line data acquisition system of the Institute for Nuclear Study includes two host computers of Fujitsu and three terminal systems. It is provided with complete CAMAC subroutines of FORTRAN, making programming easy. As examples in the Institute for Nuclear Study, experiments on measuring the differential cross-section in $\gamma P \rightarrow \gamma P$ reaction and the recoil proton polarization in $\gamma P \rightarrow \pi^0 P$ reaction are described. When γ-ray is injected to liquid hydrogen target, the protons produced by the reaction are measured with a magnetic spectrometer, and γ-ray with a γ counter, simultaneously. During data acquisition, raw data are displayed on the monitor-scope in every event, and the histograms for various quantities are checked with the graphic display of the terminal. At the end of RUN, the histograms of TDC and ADC, and those of reconstructed momentum data and others are printed out by the line printer. These are shown in illustrations.

20651 (INS-NUMA—31, pp 28-35) **Development of CAMAC data acquisition computer CCS-11.** Hayano, Ryugo (Tokyo Univ. (Japan). Faculty of Science). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8107123—).

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

The CAMAC Control Subsystem for PDP-11 and VAX-11 (CCS-11) was developed from 1979 to 1980 as the computer for special high speed data acquisition using CAMAC system. Seven

CCS-11's have been used by total 6 experimental groups so far in the National Laboratory for High Energy Physics, Japan. Thus, the initial purpose of development may have been sufficiently achieved. Data acquisition software "KEKX" developed by Chiba also largely contributed to this result. In this report, the progress and purpose of development and the design of the CCS-11 hardware are described. As a result of first investigating the data processing system for University of Tokyo meson facility (BOOM), a 32 bit miniature computer VAX-11/780 was used as the host computer, and a 16 bit computer was combined for data acquisition. VAX is a 32 bit computer produced by developing the well-known PDP-11. CCS-11 was constructed to have the functions that can execute all the PDP-11 instructions by skillfully writing microprograms, in spite of considerable hardware differences from PDP-11. Memory size is 24 Kwords as standard, of which 8 Kwords have specially high speed and contribute to improve operational speed, and other 16 Kwords are used mainly for data storing. CCS-11 can be easily linked to PDP-11 or VAX-11, and also the diagnoses of its major function can be performed using the PDP-11 diagnosis programs without any change.

20652 (INS-NUMA—31, pp 36-41) **Software KEKX system.** Chiba, Junsei (Tokyo Univ. (Japan). Faculty of Science). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8107123—).

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

For the 12 GeV proton synchrotron experiments in the National Laboratory for High Energy Physics, each experimenting group has prepared the software data processing system using about one man-year of man power independently, and employed it to the experiment so far. However, the standardization of hardware has little meaning unless the software is standardized. Seizing an opportunity when a microcomputer CCS-11 has been completed in 1981, which has the CAMAC Branch driver function, a software system has been produced for the purpose of preparing a system having the best generality without losing the high speed of CCS-11, and that is KEKX. For designing an on-line data processing software system, it seems necessary to consider the following three points: data flow and its control, complete provision of on-line monitor, and easiness of man-machine communication. These considerations are described in detail. As an example of application, the experiment by the YN group in the University of Tokyo is reported. This experiment was the one to measure the total cross-sections and forward angular distribution elastic scattering of protons and anti-protons. It required data acquisition rate as fast as possible. The typical data acquisition rate was as shown below, through the provisions of software filtering and a two-in-one adaptor which was devised to decrease the number of CAMAC cycles and data size. Ungated trigger of about 600/burst, gated trigger of about 250/burst and accepted events of about 200/burst or about 80 Kbyte/burst were obtained.

20653 (INS-NUMA—31, pp 53-58) **Development of DUMAS data processing system.** Sakamoto, Hiroshi (Kyoto Univ. (Japan). Faculty of Science). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8107123—).

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

In the field of nuclear experiments, the speed-up of data processing has been required recently along with the increase of the amount of data per event or the rate of event occurrence per unit time. In the DUMAS project of RCNP, the development of data processing system has been required, which can perform the high speed transfer and processing. The system should transfer the data of 5 multiwire proportional counters and other counters from the laboratory to the counting room at the rate of 1000 events every second, and also should perform considerably complex processes such as histogramming, particle identification, calculation of various polarizations as well as dumping to the secondary memory in the counting room. Furthermore, easy start-up, adjustment, inspection and maintenance and non-special hardware and software should be considered. A system presently being investigated for satisfying the above requirements is described. The main points are as follows: to employ CAMAC system for the interface with readout circuit, to transfer data between the laboratory and the counting room by converting the byte-serial transfer to the bit-serial optical fiber communication, and to unify the data processing computers to the PDP-11 family by connecting two miniature computers. Development of such a data processing system seems to be useful as an preparatory research for the development of NUMATRON measuring instruments.

20654 (INS-NUMA—31, pp 70-75) **Cylindrical detector system (CDS) for studying high energy hadron-nucleus reactions.** Arai, Ichiro (Tokyo Univ. (Japan). Faculty of Science). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8107123—).

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

The author's study group proposes a general purpose detector for studying hadron-nucleus reactions at the 12 GeV proton synchrotron in National Laboratory for High Energy Physics. The research which can be performed with this detector system are presently the hadron-nucleus reactions in 1 to 10 GeV region, isobar configurations in light nuclei, behaviour of isobars in nuclear materials, correlations between identical particles, studies on exotic states, etc. This detector is roughly divided into two parts, the forward particle spectrometer (FPS) and the cylindrical detector system (CDS). In this paper, the outline of a cylindrical drift chamber is described, which achieves an important role in the CDS. The performance expected for this chamber is the positional resolution in axial direction of about 2 mm, that in radial-circumferential direction of about 0.2 mm, the momentum resolution of about 5 to 10%, the energy resolution of about 20%, and the double track resolution of about 5 mm. There are a few requirements for processing data from the chamber, and the electronics system is designed considering these conditions. The system configuration employs the multi-crates system, in which one ADC-processor is alloted to 20 read out modules, and these are accomodated in one crate as one unit. The above described detector will also be useful as the central detector in NUMATRON.

20655 **(INS-NUMA—41) Stripper-foil changer system for a heavy ion accelerator.** Fujino, T.; Hattori, T.; Sugai, I.; Sakamoto, N.; Mizutani, S. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Aug 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700785.

A stripper-foil Changer system with a large foil capacity (above 360 foils) was designed. Easy changing action of the system was obtained with use of pneumatic-command control system. A case for a carbon foil was also designed. They are available a protective of the carbon foil, as grip space for fingers of the system and as roll down from upper side of the foil reservoir. The system was constructed in our INS machine shop. They has been fully operated mechanically within vacuum.

20656 **(INS-TH—149) Operation of 1.3 GeV electron synchrotron with a personal computer.** Asaoka, S.; Shiino, K.; Norimura, K.; Yoshioka, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 2 Jul 1982. 24p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700787.

A computer control system of 1.3 GeV Electron Synchrotron has been constructed. Injection timing of the linac beam to the synchrotron and inflector voltage are optimized continuously by a personal computer to maintain the beam intensity.

20657 **(IPPJ-DT—97) Construction of preliminary experimental apparatus for ERA research and study of negative mass instability under restricted boundary condition of ring circumference.** Kobayashi, N. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1982. 125p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700788.

High speed adiabatic compressor and relativistic electron beam source are prepared to study the electron ring accelerator performances and the stability of the large current electron ring. Some experimental physics problems which were met during construction are discussed. In the compression of the electron ring, a strong decay of electron ring current is observed due to the nega-

tive mass instability. The characteristics of the instability are well analysed by the pillbox model with regards to the effects of beam loading and beam self-fields.

20658 **(JINR—R-9-82-565) Accumulation of transplutonium elements in accelerators.** Dzhelepov, V.P.; Dmitrievskij, V.P.; Kol'ga, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 8p. (In Russian). (CONF-8210133—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700791.

From 8. All-Union conference on charged particles accelerators; Protvino, USSR (19 Oct 1982).

The possibility of using a neutron generator on the base of a cyclic deuteron accelerator for production of transplutonium elements (TPE), namely Cm, Bk and Cf is studied. Calculations of the TPE accumulation process when using the deuteron beam at the energy of 100 MeV and mean intensity of 100 mA for different neutron spectrum hardness in a target have been made. The obtained parameters of TPE accumulation (amount, time) are compared with the corresponding parameters of high-flux nuclear reactors and the SM-2 reactor in particular. It is shown that an increase of epithermal neutron flux density in the generator target provides essential gain in TPE accumulation time as well as an increase in corresponding isotope maximum production. The conclusion is made that installations on the base of deuteron accelerators can successfully compete with nuclear reactors used nowadays for TPE production.

20659 **(JINR—R-9-82-573) Monitor for measuring current and energy of electron bunches.** Stepanov, A.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700792.

An arrangement of a monitor with the transmission band $\Delta f = 10^{10}$ Hz designed for measuring electron bunch current up to 10^4 A at the energy E=0.2-30 MeV is described. The monitor is made as a strip line formed by a set of isolated metal plates and matched with signal transmission lines. The monitor operation is based on the use of energy dependence of electron transmission coefficient through a matter. The monitor perfomance testing made using the collective accelerator simulator has shown that the monitor does not introduce noticeable magnetic field disturbances and gives an opportunity to measure beam current shape monitor retiabitity and smatj size, simplicity of its arwithout frequency disturbances. The conclusion is made that therangement and measuring technique as well as the possibility of measurements in pulsed magnetic fields provide the wide applicability of the monitor under consideration for calibration of electron beam current and charge monitors at accelerators of different types.

20660 **(KEK—81-8) Proceedings of the plan meetings on VUV and soft x-ray instrumentation for the photon factory, Tsukuba, May and June, 1979.** Sato, Shigeru; Ishii, Takehiko (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Aug 1981. 161p. (In Japanese). (CONF-7905236—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780148.

From Meeting on VUV and soft x-ray instrumentation for the photon factory; Oho, Ibaraki, Japan (21 May 1979).

Abstracts of individual items from the proceedings were prepared separately for the data base. (GHT)

20661 **(TRI-PP—83-119) Two interactive programs for use on the VAX.** Bennett, A.W. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Nov 1983. 3p. (CONF-8311143—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900953.

From Canadan fall DECUS symposium; Calgary, Alberta, Canada (28 Nov 1983).

Portions are illegible in microfiche products .

This paper describes two programs, for use on a VAX running VMS, which are popular and useful at TRIUMF. TRIUMF is a medium-energy particle physics laboratory based on a 500 MeV cyclotron. These programs were developed originally for data handling for the muon-electron conversion experiment, using the TRIUMF time projection chamber (TPC). The first program, IO, and the related subroutines MAGTA and MAGTASS, are fairly general in application and may interest anyone who stores and accesses data on foreign-mounted tapes. IO provides features for the inspection and copying of such tapes, and the creation and access of virtual tapes on disk. The second program, REPLAY, is more specialized, and may interest users who deal with data which is binned into one- and two-dimensional histograms. It provides features for various kinds of graphic and non-graphic display of the data, for nonlinear least squares curve-fitting and for algebraic manipulation of the data.

4304 Storage Rings

REFER ALSO TO CITATION(S) 21221

20662 **(INS-TH—148) Study on superconducting accelerating cavities, 3.** Noguchi, S.; Fukushima, T.; Yoshida, K.; Yoshioka, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 26 Jul 1982. 16p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700786.

Rf-input couplers for 500 MHz superconducting cavities have been studied at the room temperature using a test cavity of KEK-spherical type with a input coupling port. A coaxial probe with a field transformer could give easily low external Q value without strong field enhancement around the coupling hole in the cavity.

20663 (KEK—81-8, pp 61-63) **Radiation control.** Uchida, Akira (Tokyo Univ. (Japan). Inst. for Solid State Physics). Aug 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-7905236—).

From Meeting on VUV and soft x-ray instrumentation for the photon factory; Oho, Ibaraki, Japan (21 May 1979).

This paper describes on how the condition of radiation level in the ring (storage ring) experimentation room changes corresponding to the operating stage of SOR-ring (synchrotron radiation storage ring), and does not describe on the present radiation control in the SOR facility. The operating stage of SOR is divided into the following five: (1) 307 MeV electron injection, (2) 307 MeV electron storage (used for SOR experiments), (3) energy increase from 307 to 380 MeV, (4) 380 MeV electron storage, (5) re-injection and completion of operation. Gamma and X ray levels are shown when the electron beam is injected from the electron synchrotron to the SOR-ring. Two main causes of the high level are reported. Spatial dose rate in storing 307 MeV electrons in also illustrated. This is sufficiently lower than that at electron incidence. The measurement of radiation level at the time of energy increase from 307 to 380 MeV has just started. Since the radiation level in 380 MeV storage, measured at the points about 20 cm apart from the electron orbit, showed several mR/h, the level seems to be negligible at the points where experiments are carried out, 1 m away from the measurement points. The radiation level in electron reinjection and completion of operation may be large during a short period (a few Roentgen) like the time of energy increase. Therefore, the beam shall be re-injected or decreased after confirming that all experimenters have retreated into the predetermined place.

20664 (KEK—81-12, pp 76-88) **Experimental halls.** Baba, H.; Chikaraishi, H.; Fujii, T. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Oct 1981. NTIS (US Sales Only), PC A04/MF A01. (CONF-8107121—).

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

A work is underway for designing experimental halls, which will be constructed in the TRISTAN Main Ring as well as in the Accumulator Ring. The present status of the work is briefly reported.

20665 (KEK—81-12, pp 104-119) **Comments on a possible detector at TRISTAN.** Totsuka, Y. (Tokyo Univ. (Japan)). Oct 1981. NTIS (US Sales Only), PC A04/MF A01. (CONF-8107121—).

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

Comments on a detector concept at TRISTAN are presented from some experiences at the JADE detector.

20666 (KEK—81-12, pp 1-15) **Report of tracking chamber subgroup.** Okuno, H. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1981. NTIS (US Sales Only), PC A04/MF A01. (CONF-8107121—).

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

The goal in the construction of tracking chambers at TRISTAN is the precise measurement of momentum and the identification of each charged particle in a high multiplicity event, even in a jet-like event in e^+e^- collisions. The clear readout of the three-dimensional positions of tracks is a critical factor in the design of the drift chamber. Many experiences on the central tracking chambers have been accumulated at various facilities, and the characteristics of MARK-2, MARK-3, etc. are summarized in this paper. Several types of chambers were studied for TRISTAN. These are JADE-type, MARK-3 type, MARK-2/CLEO type, TPC, LDC, Vertex Detector and Spherical Chamber. The tests of LDC (Longitudinal Drift Chamber) were done at KEK and INS. The figure of merit for π/p separation with 1 m samples is about 5 (KEK) at P = 1 GeV/C, and for π/e beam, it was 7 (INS) at P = 500 MeV/C. Various problems connected to the tracking chambers were discussed at the joint meeting of sub-working groups.

20667 (KEK—81-12, pp 16-29) **Report of TOF subgroup.** Yoshimura, Y.; Kichimi, H. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)); Fujiwara, N.; Yamashita, S.; Maruyama, K. Oct 1981. NTIS (US Sales Only), PC A04/MF A01. (CONF-8107121—).

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

The TOF group has made a review work concerning the development of the techniques to identify the particle species produced by electron-positron annihilation at TRISTAN. The following topics were discussed. Those are the review of TOF measurement by conventional scintillation counters, new techniques such as planar spark counters (PSC) and multichannel plate photomultipliers and others, beam pickup signals, and gas and aerogel Cerenkov counters. The TOF method loses the capability of particle identification very rapidly as the momentum of particles increases. The best time resolution can be obtained with a 5 cm thick scintillator, and is 140 psec. The factors which affect the time resolution are discussed. If the time resolution of 50 psec is realized in the course of development of PSC, π/K separation up to 2 GeV/C would be possible. The biggest problem on PSC may be the production of much larger counters (10 cm x 300 cm) keeping the uniformity of the gap and the flatness of electrode surface. Microchannel plate photomultipliers can reduce the time jitter. The time resolution of the beam pickup signal is 50 to 100 psec.

20668 (KEK—81-12, pp 30-39) **Readout electronics subgroup.** Arai, I. (Tokyo Univ. (Japan). Dept. of Physics); Fukushima, Y.; Inaba, S. Oct 1981. NTIS (US Sales Only), PC A04/MF A01. (CONF-8107121—).

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

In this paper, review of the readout electronics for the central tracking chamber at TRISTAN is described. The scale estimation for several models of the tracking chambers is also presented. There are two types of the preamplifier for the analog readout of sensing wire signals. One of them is a current sensitive type, and the other type is a charge sensitive type, which provides good S/N ratio. The pre-amplifier should be mounted directly on the chamber in order to reduce input capacitors. The time resolution must be good so as to meet a final position resolution of the chamber. Three types of time digitizer circuits (TDC) are considered. Those are the direct scaling of clock pulses, time expansion scheme, and time to analog conversion method. The analog digitizers are necessary to make dE/dx measurement, charge division to get Z coordinate, and to measure accurate position along the anode wires. Sensing wires are used for both dE/dx measurement and charge division readout. Three types of chambers, ie., JET chamber, time projection chamber and longitudinal drift chamber, are considered for scale estimation. The FASTBUS system is imposed in the system construction. The size of the data from the central tracking chamber is one of the basic parameters for designing the data acquisition system, and it was estimated.

20669 (KEK—81-12, pp 40-52) **Report of data acquisition and processing subgroup.** Endo, Ichita (Hiroshima Univ. (Japan). Dept. of Physics). Oct 1981. NTIS (US Sales Only), PC A04/MF A01. (CONF-8107121—).

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

The data acquisition and processing system of TRISTAN has been investigated by DAP group. Hardware and software tools have been studied. The tasks include the standardization of the data bus, the standardization of interface, the selection of a host computer for online measurement, to provide the software and hardware interface between the online and offline systems, the specification of the data format, the determination of microprocessor support, the design of the monitoring system and network with an accelerator or a central computer and so on. The amount of data size for the typical TRISTAN experiments was estimated. A new bus structure other than CAMAC and/or FASTBUS would not be used as the standard for the TRISTAN data acquisition system. The FASTBUS standard was defined in the document published by US NIM Committee. Brief description of the present system is presented.

20670 (KEK—81-12, pp 89-103) **Physics possibilities at TRISTAN.** Sanda, A.I. (Rockefeller Univ., New York (USA). Dept. of Physics). Oct 1981. NTIS (US Sales Only), PC A04/MF A01. (CONF-8107121—).

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

Review on the theoretical expectation at TRISTAN is presented. Discussions are given for the models with light neutral gauge boson which might be produced at TRISTAN. The start is a gauge group, SU(2) x U(1) x G, which is identical to the standard model. The value of Z boson mass was predicted. The lighter Z boson can have a mass within the energy range of TRISTAN. The mass analysis of the t-quark was made, and the chance of discovering toponium at TRISTAN is shown. It is quite possible that the new information on W and Z can be deduced from parity-violating asymmetry in the decay products of toponium. The possibility of TRISTAN making a substantial contribution to B meson physics should not be ruled out.

20671 **ISABELLE shielding criteria and design.** Gollon, P.J.; Casey, W.R. (Brookhaven National Lab., Upton, NY). *Health Physics;* **46**: No. 1, 123-132(Jan 1984). Contract AC02-76CH00016.

ISABELLE is a high-intensity 400-GeV proton-storage ring under construction at Brookhaven National Laboratory (BNL). The radiation-protection problems encountered in its design are in many ways similar to those at high-energy fixed-target facilities: both the laboratory personnel nearby and the public several kilometers away must be appropriately protected from high-energy neutron and muon radiation. These radiations will result from the routine operation of the accelerators, as well as from unplanned and possibly large losses of the stored beam. The radiation exposures resulting from the loss of beam already in the accelerator could be more severe than those resulting from a full year's normal operation. The design goals (mrem/yr) which have been adopted for different populations, exposure scenarios and radiation sources are outlined. We also describe the methods (hardware, shielding, access control) which will be used to achieve these goals.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 20051, 20654, 20718, 20812, 21405

20672 **(AD-A—134611/3) Radiac calibrators. Final report on test operations procedure.** (Army Test and Evaluation Command, Aberdeen Proving Ground, MD (USA)). 25 Jul 1983. 14p. (TOP—8-2-064). NTIS, PC A02/MF A01.

This test operations procedure (TOP) sets forth general and specific test procedures for measuring the technical performance of Radiac Calibrators. A comparison of the test results with the criteria of the technical specifications permits an evaluation of their suitability as Radiac Calibrators. This TOP applies to Radiac Calibrators designed for field-use only. This TOP describes three tests: Characteristic Calibration Energy, which characterizes the test item's radiation energy in a test cavity; Calibration Accuracy, which determines whether the test item can, with the required accuracy, calibrate each of its anticipated types of radiac meters; and Repeatability, which determines whether the test item can, with the same accuracy, repeat the required calibrations.

20673 **(CONF-840264—2) Chopper spectrometers.** Price, D.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009205.

From Workshop on high energy excitations in condensed matter; Los Alamos, CA, USA (13 Feb 1984).

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Chopper spectrometers are devices for measuring the dynamics of a condensed system, conveniently described in terms of the scattering function. The basic concepts of the chopper spectrometer and of time-of-flight analysis are briefly reviewed, followed by the performance of the instrument. Some examples illustrate the method. (LEW)

20674 **(DOE/ER/10629—T1) Hadroproduction of charmed and bottom mesons (Fermilab Experiment E-653). Annual report, 1983.** (Oklahoma Univ., Norman (USA). Dept. of Physics and Astronomy). 14 Feb 1984. Contract AS05-80ER10629. 97p. NTIS, PC A05; 3; GPO Dep. Order Number DE84008350.

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High-energy detector instrumentation development for use at a Fermilab experiment is described. Testing of the charge collection, track point resolution, and vertex reconstruction resolution of the silicon semiconductor detectors (SSD) is described. Beam testing of centronic charge sharing SSD's, time-of-flight scintillator tests, and fabrication and testing of a hadron calorimeter are reported. (WHK)

20675 **(DOE/ER/40039—7) Status of the Texas A & M GUT monopole search.** Webb, R.C. (Texas A and M Univ., College Station (USA). Dept. of Physics). 1 Jan 1984. Contract AS05-81ER40039. 15p. (CONF-8310227—6). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007463.

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

We present here a report on the status of the GUT monopole search being staged by the Texas A & M University group. This experiment is being staged underground at a depth of 1500' in a nearby salt mine and utilizes a large area ($\sim$ 53 m^2) scintillation counter telescope to detect the passage of a slow moving super heavy, magnetic monopole. A description of our detector and the expected signature for a passing magnetic monopole is presented. 11 references.

20676 **(JAERI-M—82-193) Calculation of the efficiency of ^{6}Li-glass and ^{10}B-NaI detectors by the program ELIS.** Sugimoto, Masayoshi; Mizumoto, Motoharu. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 60p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700789.

The Monte Carlo program ELIS was developed to obtain relative efficiencies of a ^{6}Li-glass scintillator and a ^{10}B-NaI detector, which were used as the incident neutron detectors in the measurements of neutron radiative capture at the Japan Atomic Energy Research Institute electron linear accelerator (JAERI linac). The calculation is based on the standard cross sections in the evaluated nuclear data files, such as JENDL-1 for ^{6}Li(n, α) reaction and ENDF/B-V for ^{10}B(n, $\alpha\gamma$) reaction, and takes into account the multiple scattering effect in the detector system, e.g. the ^{6}Li-glass scintillator and the photomultiplier window, using the conventional Monte Carlo technique. The calculated results are reliable within a few percents in a statistical meaning. However, the total uncertainties of the results are mainly due to the uncertainties or the covariances of the standard cross sections used in the calculation. This report describes the procedures of the preparation of the cross section data file and the calculational method of the relative efficiency, and discusses the uncertainties of the obtained results.

20677 **(PNL-SA—11890) Microprocessor based mobile radiation survey system.** Gilbert, R.W.; McCormack, W.D. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-65RL01830. 8p. (CONF-840202—22). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008303.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

A microprocessor-based system has been designed and constructed to enhance the performance of routine radiation surveys on roads within the Hanford site. This device continually monitors system performance and output from four sodium iodide detectors mounted on the rear bumper of a 4-wheel drive truck. The gamma radiation count rate in counts-per-second is monitored, and a running average computed, with the results compared to predefined limits. If an abnormal instantaneous or average count rate is detected, an alarm is sounded with responsible data displayed on a liquid crystal panel in the cab of the vehicle. The system also has the capability to evaluate detector output using multiple time constants and to perform more complex tests and comparison of the data. Data can be archived for later analysis on conventional chart recorders or stored in digital form on magnetic tape or other digital storage media. 4 figures.

20678 **(SLAC-PUB—3298) Large area spark counters with fine time and position resolution.** Ogawa, A.; Atwood, W.B.; Fujiwara, N.; Pestov, Yu.N.; Sugahara, R. (Stanford Linear Accelerator Center, CA (USA); Nara Women's Univ. (Japan). Dept. of Physics; AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki; National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Oct 1983. Contract AC03-76SF00515. 4p. (CONF-831015—41). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007804.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

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Spark counters trace their history back over three decades but have been used in only a limited number of experiments. The key properties of these devices include their capability of precision timing (at the sub 100 ps level) and of measuring the position of the charged particle to high accuracy. At SLAC we have undertaken a program to develop these devices for use in high energy physics experiments involving large detectors. A spark counter of size 1.2 m x 0.1 m has been constructed and has been operating continuously in our test setup for several months. In this talk I will discuss some details of its construction and its properties as a particle detector. 14 references.

20679 **(SLAC-PUB—3299) Large area spark counter with fine time and position resolution.** Ogawa, A.; Fujiwara, N.; Pestov, Yu.N.; Sugahara, R. (Stanford Linear Accelerator Center, CA (USA); Nara Women's Univ. (Japan). Dept. of Physics; AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki; National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Mar 1984. Contract AC03-76SF00515. 4p. (CONF-840396—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008203.

From International conference on instrumenhtation for colling beam physics; Novosibirsk, USSR (15 Mar 1984).

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The key properties of spark counters include their capability of precision timing (at the sub 100 ps level) and of measuring the position of the charged particle to high accuracy. At SLAC we have undertaken a program to develop these devices for use in high energy physics experiments involving large detectors. A spark counter of size 1.2 m x 0.1 m has been constructed and has been operating continuously in our test setup for several months. Some details of its construction and its properties as a particle detector are reported. 14 references. (WHK)

20680 **(UCRL—88392) Determination of the beta energy (E/sub max/) using thin window instruments.** Hankins, D.E. (Lawrence Livermore National Lab., CA (USA)). 12 Aug 1983. Contract W-7405-ENG-48. 6p. (CONF-840512—1). NTIS, PC A04/MF A01. Order Number DE83016575.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

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The use of simple survey instruments for beta-energy analysis is complicated by large differences that exist in the beta spectra shapes. These spectral shapes are often complex and change continuously as the betas are absorbed in air. Changes are also caused by absorbing material between the source and the detector. One may frequently encounter a combination of beta energies, either from multiple emissions from a single isotope or from several isotopes in the sample being evaluated. There may also be monoenergetic conversion electrons present in the sample or low-energy X rays which are absorbed in a similar fashion to betas. Obviously, a complete analysis of compelx beta spectra cannot be performed using only survey instruments. We present two methods which will give the approximate E/sub max/ of the beta energy responsible for the most significant portion of the beta dose. Either technique should give adequate information about the beta spectra to provide necessary guidance for the health physics evaluation of the exposure.

20681 **(UCRL—89896) Sensitive, real-time tritium waste water monitor.** Huntzinger, C.J.; Cate, J.L.; Dreicer, M.; Hankins, D.E. (Lawrence Livermore National Lab., CA (USA)). 21 Oct 1983. Contract W-7405-ENG-48. 6p. (CONF-840512—4). NTIS, PC A02/MF A01. Order Number DE84002009.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

The design of a real-time tritium waste water monitor is summarized and test results reported. The purpose of the monitor is to detect and mitigate either chronic or acute tritium spills. 8 references, 2 figures. (ACR)

20682 (ZfI-Mitt—69, pp 79-88) **Transit time measurements in technical plants by using a multichannel analyzer.** Deicke, H.H.; Flachowsky, J.; Rudolph, K.P. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Beiermann, N. (Brennstoffinstitut Freiberg (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Measurements of the velocity of a two-phase gas-solid flow at high mass loading in a pipeline are studied by the aid of the radioactive tracer technique. /sup 113m/In labelled single grains will be injected upstream into the flow at determined sequences of time. Its transit time between two positions of a known distance is measured, generally using scintillation detectors coupled with a special limit value switch, controling a short time meter in the first case. In the other case or simultaneously a multichannel analyzer (NTA-1024) in multiscaling mode online coupled with a programmable calculator (EMG-666) was used. In this way it is possible to measure transit times < 1 sec or flow rates > 5 m/sec. The relative error of this measurement is less than 1%. The measuring system and some experimental results are presented.

20683 (ZfI-Mitt—69, pp 175-190) **New concept of measuring free moisture in solid materials.** Burek, R.; Wojcik, K. (Uniwersytet Marii Curie-Sklodowskiej, Lublin (Poland)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The proposed method relies on measuring the intensity of backscattered radiation. The dependence of the intensity and energy distribution of the backscattered radiation on free moisture has been investigated. The physical interpretation of the effect is given and the ability of this method is discussed.

20684 (ZfI-Mitt—69, pp 191-203) **Process control system for fresh concrete preparation.** Bachvarov, N.; Pavlov, P.; Shukov, H. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika); Manolov, E.; Georgiev, I.; Tropolov, K. (Inst. of Industrial Cybernetics and Robotics, Sofia (Bulgaria)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The paper discusses the principles, structure and organization of a modular microprocessor based control system, designed to be used in fresh concrete fabrication plants. The system is based on the measurement of the aggregate moisture by means of a neutron moisture meter.

20685 (ZfI-Mitt—69, pp 215-223) **Beta backscattering instruments for coating thickness measurements in electronic and electrotechnical industry.** Petrov, A.; Srenc, A.; Hristov, H.; Penev, P.; Georgiev, G. (Plovdivski Univ. (Bulgaria)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Two models of beta backscattering gages are described for thickness measurements of metallic or non-metallic coatings applied in electronic and electrotechnical industry and various combinations of coatings and substrates in a wide range of thickness. The gages show high resolution and appropriate accuracy. In order to increase the measurement capability one model was fitted with a microprocessor. The most important additional features of this model are given including the electronic unit and the program algorithm.

20686 (ZfI-Mitt—69, pp 224-228) **Radioactive level indicator for bulk materials in containers with calculation of the residual volume.** Stuchlik, W.; Kupsch, H. Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A radiometric level indicator is described for measuring the volume and mass of bulk materials in silos and for controlling the residual quantity of materials in a silo to avoid total emptying. An example with a movable ^{60}Co gamma source in a cylindrical lime container with a central outlet is presented.

20687 (ZfI-Mitt—69, pp 323-327) **Possibilities of the development of improved smoke detectors.** Goeldner, R.; Grosse, H.J.; Gleisberg, F. Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Based on theoretical estimations and on experimental results steps are pointed out to reach improved performance and smaller dimensions of the commercially available 70130 ionization smoke detector.

20688 **Radon-immune air monitor for plutonium.** Gupton, E.D. (Oak Ridge National Lab., TN). *Health Physics;* **46**: No. 1, 217-224(Jan 1984). Contract W-7405-ENG-26.

The gross α activity in particulate-associated daughters of radon in the work environment may be many times that of one MPCa of ^{239}Pu or ^{238}Pu. The daughters of radon emit both α and β particles. The ratio of the α-to-β activity is variable and a function of several factors. In spite of this variability, the ratio changes slowly with time and has upper and lower bounds in buildings that have controlled ventilation. This provides the basis for the development of an air monitor in which the radon interference is virtually eliminated. The radon-immune air monitor has three detectors: one that detects the α activity on the filter, one that detects the β activity on the filter plus γ background, and one that observes γ background. The counts from these detectors are fed to a computer that is programmed with an algorithm for computing the non-radon-associated α activity.

20689 Mercuric iodide imaging detectors. Ortale, C.; Padgett, L.; Schnepple, W.F. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Div.). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 1, 95-101(15 Jul 1983). (CONF-820667—). Contract AC08-76NV01183.

From 5. international workshop on HgI/sub 2/ nuclear radiation detectors; Jerusalem, Israel (6 Jun 1982).

Linear and two-dimensional monolithic arrays of different configurations have been fabricated using photolithographic techniques. The fabrication technology, electronic setup, and pinhole imaging experiments are described. Spatial resolutions of 1-2 mm have been achieved.

20690 Larger volumes of HgI_2 used as portable gamma-ray counters. Warren, J.L. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Div.). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 1, 103-105(15 Jul 1983). (CONF-820667—). Contract AC08-76NV01183.

From 5. international workshop on HgI/sub 2/ nuclear radiation detectors; Jerusalem, Israel (6 Jun 1982).

Mercuric iodide detectors up to 1.5 cm in thickness and with active areas of up to 17 cm^2 were fabricated and used as room-temperature, portable, gamma-ray counters. Most of the detectors show no photopeak spectral resolution, but the end point energies of various gamma radiation sources are linear with energy. The detectors are biased with about 10^3 V/cm, which can be provided in a portable package with a rechargeable capacitor. The nuclear performance of these counters is described.

20691 Gamma-ray spectrometry with thick mercuric iodide detectors. Beyerle, A.; Hull, K.; Markakis, J.; Lopez, B. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Div.); Szymczyk, W.M. (University of Southern California, Marina Del Rey (USA). Inst. for Physics and Imaging Science). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 1, 107-113(15 Jul 1983). (CONF-820667—). Contract AC08-76NV01183.

From 5. international workshop on HgI/sub 2/ nuclear radiation detectors; Jerusalem, Israel (6 Jun 1982).

Also published as report DOE/NV--01183-214-TP, 1982.

Gamma-ray spectra with energies up to 1.3 MeV hase been detected for the first time with 1 cm thick HgI_2 semiconductor detectors at room temperature. The spectra can be taken using a 'long', 10 μs, or a 'short', 0.5 μs, charge collection time. The latter has produced better results with better peak efficiency, higher peak-to-valley ratio, and fewer low energy counts with little sacrifice in resolution. Spectra for energies between 100 keV and 1.3 MeV and descriptions of the techniques for their acquisition are presented. The thick detectors need a conditioning treatment, which is described, prior to showing spectral response.

20692 Gamma-ray spectrometry with solid-state detectors by current pulse height analysis. Szymczyk, W.M.; Dabrowski, A.J.; Iwanczyk, J.S.; Kusmiss, J.H.; Huth, G.C. (University of Southern California, Marina Del Rey (USA). Inst. for Physics and Imaging Science); Hull, K.; Beyerle, A.; Markakis, J. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Div.). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 1, 115-122(15 Jul 1983). (CONF-820667—). Contract AC08-76NV01183.

From 5. international workshop on HgI/sub 2/ nuclear radiation detectors; Jerusalem, Israel (6 Jun 1982).

Also published as report DOE/NV--01183-213-TP, 1982.

The traditional way of doing gamma-ray spectrometry with semiconductor detectors depends on being able to collect the ionization charge. In most cases, hole trapping limits the spectrometric performance of room-temperature detectors made from compound semiconductors. Recently it has been shown for thick HgI_2 detectors that significant improvement can be produced by using a technique of unconventionally short differentiation of the detector pulses. The present paper presents the concept underlying the technique and gives its theoretical background. The method consists of measuring the amplitude of ionization current pulses before charge collection is completed rather than measuring the amount of charge collected. Hole collection is obviated, and the transport of electrons becomes the most important consideration. The conditions under which this novel method can be applied to various semiconductor materials are discussed. Two different approaches toward the electronic implementation of the technique are compared.

20693 Scintillation spectrometry with HgI_2 as the photodetector. Iwanczyk, J.S.; Barton, J.B.; Dabrowski, A.J.; Kusmiss, J.H.; Szymczyk, W.M.; Huth, G.C. (University of Southern California, Marina Del Rey (USA). Inst. for Physics and Imaging Science); Markakis, J.; Scnepple, W.F.; Lynn, R. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Div.). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 1, 123-126(15 Jul 1983). (CONF-820667—). Contract AM03-76SF00113;AC08-76NV01183.

From 5. international workshop on HgI/sub 2/ nuclear radiation detectors; Jerusalem, Israel (6 Jun 1982).

Also published as report DOE/NV--01183-210-TP, 1982.

A mercuric iodide (HgI_2) photodetector has been used to detect light pulses from gamma-ray and alpha-particle interactions in scintillators. The photocurrent response of an HgI_2 photodetector to light has been measured and found to be favorable for detecting light from most scintillators, which have their maximum emission between 400 and 560 nm. Energy spectra for alpha particles or gamma-rays from combinations of an HgI_2 photodetector with various scintillators are presented. The energy resolution of the photopeak from annihilation gamma-rays is 19% with a CsI(Tl) crystal and 24% with a BGO crystal. Fabrication of HgI_2 photodetectors and their optical coupling to a scintillator crystal will be described. The advantages of this new solid-state radiation detector compared to the combination of scintillator and PMT, and some proposed applications, are discussed.

20694 Mercuric iodide (HgI_2) semiconductor devices as charged particle detectors. Beccetti, F.D.; Raymond, R.S.; Ristinen, R.A. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.); Schnepple, W.F.; Ortale, C. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Div.). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 1, 127-132(15 Jul 1983). (CONF-820667—). Contract AC08-76NV01183.

From 5. international workshop on HgI/sub 2/ nuclear radiation detectors; Jerusalem, Israel (6 Jun 1982).

Also published as report DOE/NV--01183-204-TP, 1981.

The properties of HgI_2 semiconductor devices as charged particle detectors have been investigated. Nearly linear energy response with fwhm resolution of 5-15% is observed for sup(1.2)H and sup(3.4)He ions, E < 40 MeV. Fast proton damage is observed for > 10^{10} protons/cm^2. However, based on measurements with the HgI_2 detectors, little fast neutron damage is apparent at fluences up to 10^{15} neutrons/cm^2. This suggests considerably greater resistance to radiation damage than is observed for Si and other solid state devices.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 20229, 20230

20695 (CERN—83-08) Long-term radiation effects on commercial cable-insulating materials irradiated at CERN. Maier, P.; Stolarz, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 4 Aug 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701078.

Long-term irradiation damage tests have been carried out on a variety of flexible cable-insulating materials offered to CERN by different European cable manufacturers. Tensile test specimens were exposed for a maximum of three years in high-level radiation areas of the Super Proton Synchrotron (SPS) and for comparison at high dose rates in a nuclear reactor. The degradation of mechanical properties after irradiation in air depends not only on the total absorbed dose, but also on the dose rate for most of these polymer compounds. These dose-rate effects vary between material types and for different compounds. The results presented here illustrate the difference in radiation damage between short-term and long-term irradiation conditions in a typical service application for the various materials tested. They also allow safety factors to be esti-

mated for the extrapolation of the limiting exposure in service from accelerated material tests in the range of dose rates covered. A discussion of the available models of the dose-rate effects results in a conservative estimate for extrapolation to low dose rates from measured values at intermediate dose rates of the order of 0.1 Gy/s. Based on short-term irradiation tests only, the safety factors to be applied depend on the end-point criterion used, and may vary between 1 and 10 for the range of dose rates and materials considered here.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 19605, 19657, 20126

20696 **(ABCC—15-60) Automatic shadowing device for electron microscopy.** Bishop, F.W.; Bogitch, S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1960. Contract AC01-76EV03081. 8p. (In Janapese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008144.

For the past ten years in the laboratory of the Department of Nuclear Medicine and Radiation Biology at the University of California, and before that at Rochester, New York, every evaporation was done with the aid of an automatic shadowing device. For several months the automatic shadowing device has been available at the Atomic Bomb Casualty Commission (ABCC) Hiroshima, Japan with the modifications described. 1 reference.

20697 **(AD-A—134458/9) Evolution of spontaneous and coherent radiation in the free electron laser oscillator. Interim report.** Sprangle, P.; Tang, C.M.; Bernstein, I. (Naval Research Lab., Washington, DC (USA)). 16 Aug 1983. 40p. (NRL-MR—5110). NTIS, PC A03/MF A01.

An analysis of the free electron laser (FEL) oscillator start-up problem in the linear regime is presented. The model is spatially one dimensional, though many important three dimensional effects are included heuristically. The electron beam consists of pulses of arbitrary shape separated by approximately twice the radiation transit time. The small gain/pass approximation is employed in deriving an energy rate equation, which described the evolution of the radiation pulses within the resonator. The wiggler field is assumed to occupy a portion of the finite Q resonator. In the energy rate equation, the spontaneous (incoherent) radiation term is represented by a source matrix, while the stimulated (coherent) radiation term is represented by a gain matrix. The effect of small variations in the mirror separation are investigated in the context of laser lethargy. Our analysis suggests possible methods which would substantially shorten the start-up times in FEL oscillators. Finally, our results are compared with the FEL oscillator experiments performed at Stanford University.

20698 **(AD-A—134657/6) Digital filter representation of the ASQ-81 magnetometer. Master's thesis.** Huete, M.C. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1983. 122p. NTIS, PC A06/MF A01.

A digital filter representation of the ASQ-81 magnetometer is derived from the s-plane transfer functions of the system through the use of a bilinear transformation. A FORTRAN computer program is written which applies this representation to time-sampled total magnetic field data in order to obtain a time series representation of ASQ-81 filtered total field. A series of simulations and a field experiment are conducted which verify the program output. Applications of this program include usage in conjunction with geomagnetic field data in order to produce a new data set representative of geomagnetic noise observed by Navy MAD (Magnetic Anomaly Detection) aircraft with the potential to investigate techniques of reducing geomagnetic noise in MAD aircraft.

20699 **(DOE/MC/16472—T1) Experimental investigation of a staggered array magnetic filter, July 17-September 16, 1981.** Vehse, W.E. (West Virginia Univ., Morgantown (USA)). Jul 1982. Contract AT21-81MC16472. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009913.

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This report describes an experimental investigation of the performance of a staggered array of parallel ferromagnetic fibers in capturing small paramagnetic particles. These test results are intended to be compared with [W.H. Simons and R.P. Treat, J. Appl. Phys., 51, 578 (1980)], the theoretical predictions of Simons and Treat for such a magnetic filter. Although those comparisons were not made under this contract, it should be noted that the comparisons are favorable within experimental error. The magnetic filter was designed, built, and its performance tested. The actual performance results are discussed under results. The filter design and construction details are provided for in the Experimental Design and Procedure section. 3 references, 2 figures.

20700 **(SAND—84-0668C) Comparison of methods for estimating coherence.** Stearns, S.D.; Solomon, O.M. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 6p. (CONF-840371—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009954.

From International conference on acoustics, speech and signal processing; San Diego, CA, USA (19 Mar 1984).

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Two methods for estimating coherence are compared experimentally. The first is the traditional method where power spectra are estimated using averaged periodograms. The second method involves power spectral estimates that are obtained via adaptive modeling. The experimental conditions are similar to those that might be expected in working with seismometers.

20701 **(UCID—20007) Timing and control monitor system upgrade design document. Version 4.** Brandt, J.J. (Lawrence Livermore National Lab., CA (USA)). 24 Jan 1984. Contract W-7405-ENG-48. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84006783.

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This is a design document for the Timing and Control Monitor System Upgrade Project. This project is intended to provide a replacement system for the existing user Encoder Monitor Systems and Varian 72 Control Room computer systems. All of these systems reside at the Nevada Test Site. The function of the T and C Monitor System is to gather real-time statistics and data on user defined key variables from control, communication, data acquistion systems, and from the monitoring system itself. The control, communication, and data acquisition systems each operate separately from the monitor system. The T and C Monitor System gathers this data in order to verify the readiness of an event to begin countdown. This includes setup, verification, calibration, and peripheral services, report any failures that may occur during the countdown, verify detonation and containment, and assist reentry activities after the event.

20702 **Selective counting of krypton atoms using resonance ionization spectroscopy.** Chen, C.H.; Kramer, S.D.; Allman, S.L.; Hurst, G.S. (Chemical Physics Section, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Applied Physics Letters;* **44**: No. 6, 640-642(15 Mar 1984). Contract W-7405-ENG-26.

Resonance ionization spectroscopy (RIS) was used to count 1000 individual ^{81}Kr atoms. In the method, lasers for RIS are used to obtain atomic species (Z) selectivity and a small quadrupole mass spectrometer provides isotopic (A) selectivity. After Z and A selection the krypton ions were counted as they were implanted into a target. Basically, the method works for any isotope whether stable or unstable. However, the detection limit may depend on the isotope because of outgassing of stable atoms from the enclosure walls. For ^{81}Kr, we show that fewer than 1000 atoms can be counted with good accuracy.

20703 **Fast, self-compensating spectral-scanning ellipsometer.** Muller, R.H.; Farmer, J.C. (Lawrence Berkeley Laboratory, Materials and Molecular Research Division and Department of Chemical Engineering, University of California, Berkeley, Berkeley, California, 94720). *Review of Scientific Instruments;* **55**: No. 3, 371-374(Mar 1984). Contract AC03-76SF00098.

The advantages of rapid spectral scanning have been combined with the inherent accuracy of the compensating ellipsometer operated in the polarizer-compensator—sample-analyzer configuration. Wavelength is scanned over the visible—UV (370—720 nm) at a maximum rate of 114 nm/s by rotating a continuously variable interference filter. A three-reflection Fresnel rhomb serves as the achromatic quarter-wave compensator. A microcomputer is used to collect spectroscopic measurements, perform instrument calibrations, digital filtering, and data interpretation.

20704 **Rotor for centrifugal fast analyzers.** Lee, N.E. (to Dept. of Energy). US Patent Application 6-442,065. 1984. 12p. Contract W-7405-ENG-26.

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The invention is an improved photometric analyzer of the rotary cuvette type, the analyzer incorporating a multicuvette rotor of novel design. The rotor (a) is leaktight, (b) permits operation in the 90° and 180° excitation modes, (c) is compatible with extensively used Centrifugal Fast Analyzers, and (d) can be used thousands of times. The rotor includes an assembly comprising a top plate, a bottom plate, and a central plate, the rim of the central plate being formed with circumferentially spaced indentations. A uv-transmitting ring is sealably affixed to the indented rim to define with the indentations an array of cuvettes. The ring serves both as a sealing means and an end window for the cuvettes.

45 EXPLOSIVES AND EXPLOSIVES

4501 Chemical

20705 **(AD-A—134193/2) Development of the Mk-112 detonator. Final report sep 80-sep 82.** Baudler, B.A.; Simpson, B. (Naval Surface Weapons Center, Silver Spring, MD (USA)). 1 Dec 1982. 35p. NTIS, PC A03/MF A01.

A new detonator, the Mk-112, has been developed and evaluated as a possible replacement for the Mk 57 mod 1 detonator. Its use may be necessary in applications where lead wires are desired in place of contact pins. The Mk-112 has also been designed to be protected from hazards of electrostatic discharge by the application of a conductive coating, Electrodag R plus 501, and a protective varnish to the back of each detonator plug. By doing so, a low resistance electrical contact will be formed between the lead wires and detonator case. These coatings can be applied at a minimal cost and were able to withstand all environmental and mechanical conditions required by MIL-I-23659 for EED design.

20706 **(AD-A—134347/4) Encyclopedia of explosives and related items. Volume 10.** Kaye, S.M. (Picatinny Arsenal, Dover, NJ (USA)). 1983. 788p. (PA-TR—2700-VOL-10). NTIS, PC $43.50/MF $43.50.

This volume contains entries for U through Z; Errata; and Index for Encyclopedia Volumes 1 through 10.

20707 **(SAND—83-1288) MC1442 aging and compatibility studies.** Massis, T.M.; Bradley, G.H. Jr. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 44p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009963.

An aging and compatibility study has been conducted with the MC1442 thermal battery igniter to determine the effects of a hydrogen atmosphere on the energetic materials. Igniters were aged up to one (1) year at 70°C in a 50/50 hydrogen/helium and also a pure helium atmosphere to simulate a 25-year aging environment at the normal thermal battery storage temperature. Functional testing with the igniter, including an all-fire Langley sensitivity format, function time and photographic flame profile measured no deviations from baseline samples. Analytical testing for changes in the energetic materials during aging measured less than 5% reaction of the nitrocellulose and no detectable reaction of the LMNR/$KC10_3$ ignition mixture. The hydrogen atmosphere reacted with the nitrocellulose at a rate greater than two times that observed for the helium-aged igniters. Since igniter performance was not affected by aging in hydrogen or helium, it was concluded that the MC1442 would function reliably in a thermal battery environment containing hydrogen.

20708 **(SAND—83-1929) Study of deflagration-to-detonation transition (DDT) in the granular explosive, CP.** Baer, M.R.; Igel, E.A.; Nunziato, J.W.; Gross, R.J. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1984. Contract AC04-76DP00789. 60p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009500.

In this report, we present an experimental and theoretical study of the combustion processes associated with deflagration-to-detonation transition in the granular explosive, CP. Image-enhanced, high-speed streak photography recorded the various stages of flame spread within heavily confined charges as viewed through a lexan window in a thick wall, stainless steel tube. To describe these observations we apply a multiphase reactive flow model based on the theory of mixtures. This nonequilibium model treats each phase as fully compressible and incorporates a compaction model for the granular reactant. Formulation of the constitutive models includes a pressure-dependent burn rate and experimentally-determined porous bed permeability. Predictions of this model agree well with experimental observations.

20709 **(UCRL—89846) New developments in cylinder testing.** Lee, E.; Breithaupt, D.; Parker, N.; Walton, J.; Von Holle, W.G. (Lawrence Berkeley Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 15p. (CONF-8311104—2). NTIS MF A01; 2; GPO Dep. Order Number DE84002782.

From Physics of explosives technical meeting; Unterluss, F.R. Germany (2 Nov 1983).

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Recent work on the measurement diagnostics and analysis of the cylinder test has increased the precision and the resolution several fold. We are employing both Fabry-Perot interferometry and higher speed, higher magnification streak cameras. The tests are now commonly carried out using 2 in. (5.08 cm) copper tubes instead of 1 in. (2.54 cm) tubes. The tube wall thickness is, however, unchanged .1 in. (.25 cm), which effectively increases the time resolution. The early expansion history [i.e., for $V/V_0 < 3$] can now be evaluated with high precision. The analysis of cylinder test data for composite explosives reveals the key factors which control explosive performance. Test data on mixtures of ammonium nitrate (AN) and TNT and mixtures of HMX, TATB and BTF demonstrate the importance of particle size, stoichiometry and temperature.

4502 Nuclear

20710 **(ABCC—12-59) Determination of the burst point and hypocenter of the atomic bomb in Hiroshima.** Arakawa, E.T.; Nagaoka, S.; Woodbury, L.A.; Mizuki, M. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1 Dec 1959. Contract AC01-76EV03081. 44p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008463.

The data presented show that the point of detonation of the Hiroshima A-bomb is 606 meters directly above the co-ordinates 744.281 x 1261.696 on the US Army Map Service map of Hiroshima (AMS L902, 1945). The standard deviation of the mean burst height is 2 meters and that of the hypocenter (ground zero) is 1.2 meters in the x co-ordinate and 0.6 meter in the y co-ordinate. The hypocenter determined in this report is 22 meters away from that determined by Kimura and Tajima and 35 meters from the Woodbury and Mizuki hypocenter presently used at ABCC for dosage calculations. However, if the assumption is made that the hypocenter is correct in relation to the Shima Hospital and that the co-ordinate system is slightly in error, the Woodbury and Mizuki hypocenter co-ordinates become 44.305 x 61.705 according to the co-ordinate system used in this report. This is only 23 meters away from the point determined in this report. These differences are within the probable errors of the previous determinations. 8 references, 11 figures, 1 table.

20711 **(ABCC—26-59) Measurement of the residual radiation intensity at the Hiroshima and Nagasaki atomic bomb sites. Penetration of weapons radiation: application to the Hiroshima and Nagasaki studies.** Pace, N.; Smith, R.E.; Ritchie, R.H.; Hurst, G.S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 56p. (In Japanese and English). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008111.

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This document contains 2 reports. The first is on the measurement of residual radiation intensity at the Hiroshima and Nagasaki bomb sites, the second is on the penetration of weapons radiation at Hiroshima and Nagasaki. Separate abstracts have been prepared for each report for inclusion in the Energy Database. (DMC)

20712 **(ABCC-TR—5-66) Epicenters of the atomic bombs. I. An estimate based on thermal ray shadows, Nagasaki.** Hubbell, H.H. Jr.; Arakawa, E.T.; Nagaoka, Shogo; Ueda, Shoichi; Tanaka, Sunao. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 24 Mar 1966. Contract AC01-76EV03081. 19p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008115.

The hypocenter or ground zero and the burst height of the atomic bomb at Nagasaki have been redetermined by statistical analysis of about 300 shadows cast by the thermal rays of the bomb at 21 locations. In terms of the coordinates of the wartime US Army Map of Nagasaki series AMS 1902, No. 138,353, dated August 1945, these coordinates are: x = 1293.644 (E - W) y = 1065.927 (N - S). The unit is 1000 yards and the coordinates are in terms of the 1000-yard world polyconic grid, band III N. Zone C. The calculated average burst height above the hypocenter and its probable error were: H = 500 +- 9 meters. The coresponding figures currently in use at ABCC are: x = 1293.61; y - 1065.92; H = 490 meters. The differences between these and the new values are within the errors of measurement and calculation. The new point is 32 meters from the currently used one. 4 references, 3 figures.

20713 **(AD-A—134721/0) Thermal simulation facilities handbook. Technical report.** Miller, R.H. (Department of Defense Nuclear Information Analysis Center, Santa Barbara, CA (USA)). 1 Feb 1983. 110p. (DASIAC-SR—194). NTIS, PC A06/MF A01.

The purpose of this document is to provide persons working in the area of nuclear thermal radiation with a reference document which characterizes thermal simulation facilities having direct or potential application to studies and experiments involving simulated nuclear thermal pulses. The material is arranged to provide the interested experimenter with sufficient facility information to reach a decision in the planning stage for conduct of thermal tests.

20714 **(AD-A—134726/9) Radiative properties of a nuclear thermal source simulator. Final report 1 Aug 79-31 Dec 80.** Dudziak, W.F.; Lad, P.V. (Information Science, Inc., Santa Barbara, CA (USA)). 31 Dec 1980. 146p. (RM—80-ISI101). NTIS, PC A07/MF A01.

This report summarizes some of the thermal properties of an SAI thermal radiation source (TRS). Its purpose is to illustrate some of the significant time dependent surface fluctuations that do exist in such a radiator which are not present in a nuclear device. These surface fluctuations should be considered in planning experiments, as well as in the interpretation of the collected data. The report also illustrates the courseness of the approximation of the actual source by current computer codes. In these codes each module is represented by a linear array of constant point source radiators along the axis of symmetry of the module. Summarized are the thermal flux, fluence and spectral data derived from two film records of a typical gas filled SAI thermochemical simulator that releases energy through aluminum oxidation reactions. From this summary an estimate is made of the total emissivity of this aluminum oxidation reaction. Also presented in the Annex are preliminary measurements and analysis of thermal data of a liquid oxygen system. These measurements were made during the development tests of this LOX TRS source for the MILLRACE program. Spectral surface measurements show that this source radiates at a significantly higher temperature and may possess a spectral emissivity that differs significantly from the gas module TRS source.

20715 **(AD-A—134735/0) Operation GREENHOUSE-1951. Final report.** Berkhouse, L.; Davis, S.E.; Gladeck, F.R.; Hallowell, J.H.; Jones, C.B. (Kaman Tempo, Santa Barbara, CA (USA)). 15 Jun 1983. 334p. NTIS, PC A15/MF A01.

GREENHOUSE was a four-detonation atmospheric nuclear weapon's test series conducted in the Marshall Islands at Enewetak Atoll in April and May 1951. This is a report of DOD personnel in GREENHOUSE with an emphasis on operational radiological safety.

20716 **(LA—9903-MS) Fireball spikes: the Plumbbob Boltzmann and Franklin rope tricks.** Peaslee, A.T. Jr. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84004478.

Some experiments, aptly called rope tricks, were performed on Plumbbob events Boltzmann and Franklin to further studies on spikes on fireball photography. These form on long cables emanating from tower or balloon cabs. The most interesting data resulted from a black cable between a weather balloon and the tower cab on Boltzmann. The report contains results previously available in internal Los Alamos documents written in 1957.

20717 **(UCID—19938) Effects of pore fluids at the Pacific proving grounds: a simulation of the KOA event.** Burton, D.E.; Bryan, J.B.; Swift, R.P.; Moran, B. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01; 3; GPO Dep. Order Number DE84007092.

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A new constitutive model has been developed to describe the response of the ground to the shock effects of a surface nuclear explosion. The model is applied to the KOA event, taking into account pore pressure effects. (ACR)

20718 **(UCID—19995) Edge blurring in stacked x-ray film screen combinations.** Lyle, J.W. (Lawrence Livermore National Lab., CA (USA)). 6 Feb 1984. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009658.

The Advanced Experiments Group of B-Division, LLNL, has been seeking to improve the sensitivity and spatial resolution of stacked film screens for bremsstrahlung flash radiography of imploding, dense metal shells. In the work reported here, we experimentally measured the spreading of the x-ray shadow of the edge of a uranium block in two film-and-screen combinations. We also used the SANDYL code, which models photon and electron scattering, to calculate the theoretical edge spreading in an array of films and screens. Experimentally, the uranium edge was spread to a width of 1.7 mm in the combination 0.15-mm-Ta/NDT9-XAR5, and 1.5 mm in the combination 0.25-mm-Ta/NDT6-XAR5. The theoretical calculation agreed with these results.

20719 **(UCID—20033) GLODEP2: a computer model for estimating gamma dose due to worldwide fallout of radioactive debris.** Edwards, L.L.; Harvey, T.F.; Peterson, K.R. (Lawrence Livermore National Lab., CA (USA)). Mar 1984. Contract W-7405-ENG-48. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009347.

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The GLODEP2 computer code provides estimates of the surface deposition of worldwide radioactivity and the gamma-ray dose to man from intermediate and long-term fallout. The code is based on empirical models derived primarily from injection-deposition experience gained from the US and USSR nuclear tests in 1958. Under the assumption that a nuclear power facility is destroyed and that its debris behaves in the same manner as the radioactive cloud produced by the nuclear weapon that attached the facility, predictions are made for the gamma does from this source of radioactivity. As a comparison study the gamma dose due to the atmospheric nuclear tests from the period of 1951 to 1962 has been computed. The computed and measured values from Grove, UK

and Chiba, Japan agree to within a few percent. The global deposition of radioactivity and resultant gamma dose from a hypothetical strategic nuclear exchange between the US and the USSR is reported. Of the assumed 5300 Mton in the exchange, 2031 Mton of radioactive debris is injected in the atmosphere. The highest estimated average whole body total integrated dose over 50 years (assuming no reduction by sheltering or weathering) is 23 rem in the 30 to 50 degree latitude band. If the attack included a 100 GW(e) nuclear power industry as targets in the US, this dose is increased to 84.6 rem. Hotspots due to rainfall could increase these values by factors of 10 to 50.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

20720 (DOE/EV/10098—T2) Spatial patterns of climate and climatic change. Progress report, FY 1983 (1 April 1983-27 February 1984). Part I. Summary report, appendices 1-5. Wigley, T.M.L. (East Anglia Univ. (UK). Climatic Research Unit). 27 Feb 1984. Contract AC02-79EV10098. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010253.

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This project is broadly concerned with establishing and interpreting spatial patterns of climatic change over the past 150 years. The aims are to obtain insight into possible changes which might occur in a high-CO_2 warmer world, either using the analogue or scenario approach, or through a better understanding of the processes which cause climatic change on time scales of years to decades; and to develop a data base of instrumental climate information from which the characteristics of natural climatic variability can be defined, and to analyze these data in order to facilitate the early detection of the effects of CO_2-induced climatic change.

20721 (LBL—15878-Rev.) Indoor air pollution due to emissions from unvented gas-fired space heaters. Revision. Traynor, G.W.; Girman, J.R.; Apte, M.G.; Dillworth, J.F.; White, P.D. (Lawrence Berkeley Lab., CA (USA); Consumer Product Safety Commission, Bethesda, MD (USA)). Jan 1984. Contract AC03-76SF00098. 38p. (CONF-830617—6-Rev; EEB-Vent—83-6). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009243.

From 76. annual meeting of the Air Pollution Control Association; Atlanta, GA, USA (19 Jun 1983).

Operation of an unvented combustion appliance indoors can elevate pollutant concentrations. Under laboratory conditions, the oxygen consumption rates and the pollutant emission rates of CO, CO_2, NO, NO_2, HCHO and submicron suspended particles emitted from eight unvented gas-fired space heaters operated with well adjusted air shutters at partial and full fuel consumption rates in a 27-m^3 chamber were determined. Emission rates were also determined for some heaters operating under poorly tuned conditions. Four of the eight heaters were subsequently tested in a 240-m^3 research house with .36 to 1.14 air changes per hour. Based on measurements near steady-state, projected steady-state pollutant and oxygen levels were: 1930 to 11,100 ppM for CO_2, 1.0 to 26 ppM for CO (under well-tuned conditions), 0.40 to 1.46 ppM for NO_2, and 19.1 to 20.7% for O_2. Concentrations of CO_2, CO, and NO_2 were sometimes observed to be above outdoor or occupational guidelines. Analysis showed that CO, NO, and NO_2 emission rates can vary with time and that, while short-term emission rates derived from laboratory tests were consistent with initial emission rates observed in the field, they did not always correspond to steady-state emission rates. 18 references, 9 figures, 6 tables.

20722 Climate and climate impact scenarios for Europe in a warmer world. Lough, J.M.; Wigley, T.M.L.; Palutikof, J.P. (Climatic Research Unit, University of East Anglia, Norwich, NR4 7TJ United Kingdom). *Journal of Applied Meteorology;* **22**: No. 10, 1673-1732(Oct 1983). Contract AC02-79EV10098.

Scenarios for Europe in a warmer world, such as may result from increased atmospheric carbon dioxide levels, have been constructed using the early 20th century warming as an analogue. Mean temperature, precipitation and pressure patterns for the period 1934-53 were compared with those for 1901-20. These are the warmest and coolest twenty-year periods this century based on Northern Hemisphere annual mean surface air temperature data, differing by 0.4°C. The climate scenarios show marked subregional scale differences from season to season, and individual season scenarios often show little similarity to the annual scenario. Temperature scenarios show warming for the annual mean and for spring, summer and autumn. The largest positive changes are found in higher latitudes. Winters over a large part of Europe are actually cooler and show greater interannual variability during the warmer period. These changes appear to be associated with a greater frequency of blocking activity. Precipitation changes occur in both directions in all seasons. There is, however, an overall tendency for spring and summer to be drier and autumn and winter to be wetter.

20723 Albedo following fire in a Northern Hardwood Forest. Jurik, T.W.; Gates, D.M. (University of Michigan Biological Station, Pellston, Minnesota 49769). *Journal of Applied Meteorology;* **22**: No. 10, 1733-1828(Oct 1983). Contract AC02-79EV10091.

Changes in albedo were tracked following fire on 18 August 1980 in a successional hardwood forest in northern lower Michigan (43°33'N, 84°42'W). Shortwave albedo (300—3000 nm) changed little with zenith angle up to 55°, but then increased rapidly. The rate of change in albedo with zenith angle was highest in July and lowest in early spring and late autumn. Midday albedo increased from 7.7% five days after the fire to 10.8% after six weeks. During the 1981 and 1982 growing seasons, albedo increased from 10.4 and 13.6% to mid-May to peaks of 17.8 and 18.1% in early July, respectively, with values then declining through autumn. Albedo increased with percent coverage of ground surface with live vegetation up to 35% cover, with little further change in albedo with cover, up to the maximum observed value of 70%. The ratio at midday of albedo in visible wavelengths (400—700 nm) to total shortwave albedo decreased from 0.49 in mid-May 1982 to a minimum of 0.22 in mid-July and then increased to 0.45 in mid-October, after leaf-fall. Midday shortwave albedo during winter varied from 91% over fresh snow to 76% over old, compacted snow.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 19646, 20758, 21134, 21135

20724 (DOE/NBB—0053) Response of unmanaged forests to CO_2-induced climate change: available information, initial tests, and data requirements. Solomon, A.M.; Tharp, M.L.; West, D.C.; Taylor, G.E.; Webb, J.W.; Trimble, J.L. (Oak Ridge National Lab., TN (USA)). Apr 1984. Contract AC05-84OR21400. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84009664.

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The scientific literature is reviewed to determine how tree recruitment, growth, and mortality are related to climate directly and indirectly through climate's modulation of plant competition, succession, and migration. The resulting potential responses of forest communities to climate changes expected under increased atmospheric CO_2 concentrations are described. Empirical data sets, containing measurements of climate variables and tree densities in the eastern United States, are evaluated for their potential use in statistical projections of forest responses to climate change. Also evaluated for projection purposes is a forest-stand simulation model based on many of the processes which determine forest dynamics. The ability of the model to reproduce extant forests at 21 sites in eastern North America was first verified. Then, a model experiment simulated responses of forests at those 21 locations to a scenario in which climate responds to doubling and quadrupling of CO_2. The implications of the forest simulations are discussed in terms of internal forest dynamics and requirements for specified information from climate projections, as well as for additional model developments that could address remaining ecological uncertainties. 236 references, 35 figures, 4 tables.

20725 **(DOE/NBM—4007527) Joint hearing on carbon dioxide and the greenhouse effect. Testimony presented to Subcommittee on Natural Resources, Agriculture Research and Environment and Subcommittee on Investigations and Oversight of the Science and Technology Committee, US House of Representatives.** Trabalka, J.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007527.

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This testimony describes the DOE Carbon Cycle Research Program. Separate sections describe the technical objectives of the program, ongoing research activities, and future needs. (ACR)

20726 **(EPRI-EA—3064) Plume model validation and development field measurements - plains site. Final report.** Cher, M.; Joncich, A.; McDade, C.; Schwall, R.; Waldron, T. (Rockwell International Corp., Newbury Park, CA (USA). Environmental Monitoring and Services Center). Feb 1984. 203p. EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303.

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Field data for validating plume models were collected in and around the Kincaid Power Plant from March 1980 to June 1981. Measurements conducted over periods totalling approximately 13 months consisted of aerometric, meteorological and continuous source sampling. These measurements were supplemented by three 3-week intensive measurements periods in 1980 and 1981 which involved SF_6 tracer release and analysis, mobile aerometric sampling, ground-based particulate lidar measurements, additional temperature-sonde measurements and stack sampling, and instrumented aircraft measurements to track and characterize the plume. Data capture for most routine aerometric, meteorological and source measurements was above 80%. Tracer measurements amounted to 100, 152 and 123 hours in each of the three intensive periods, whereas the goal was 150 hours each. System and performance audits conducted periodically during the course of the project documented the magnitude of experimental error. Errors typically ranged from 0 to 20%, depending on the measurement type. Very little data was invalidated because of excessive error. 3 references, 22 figures, 34 tables.

20727 **(EPRI-EA—3076) Operational validation of Gaussian plume models at a plains site. Final report.** Reynolds, S.D.; Seigneur, C.; Stoeckenius, T.E.; Moore, G.E.; Johnson, R.G.; Londergan, R.J. (Systems Applications, Inc., San Rafael, CA (USA); TRC Environmental Consultants, Inc., East Hartford, CT (USA)). Feb 1984. 202p. Research Report Center, Box 50490, Palo Alto, CA 94303.

As part of the Operational Validation Phase of the EPRI Plume Model Validation and Development (PMV and D) Project, three standard Gaussian air quality models have been evaluated by comparing predicted power plant impacts with ground-level measurements. The data used for model evaluation were collected over flat terrain near the Kincaid Generating Station during 1980 and 1981. The models were run in a hands-off mode in accordance with model documentation and were evaluated using onsite and NWS meteorological inputs. Model predictions were compared with 5000 hours of SO_2 measurements at 28 fixed stations and 300 hours of SF_6 tracer measurements collected using a movable array of 200 samplers. The models evaluated were CEQM (equivalent to EPA's CRSTER model), TEM (developed by Texas Air Control Board), and MSDM (developed by Lawrence Livermore Laboratory). Results showed a number of characteristics common to all three models including: predictions of magnitude and location of short-term ground-level concentrations are subject to large uncertainties and predicted frequency distributions of concentration values show departures from the observed distribution. The models showed differences in peak concentration values (regardless of time or location). For peak 1-hour values, CEQM overpredicted the two highest values by up to 70% and predicted the fifth highest tracer and SO_2 values within 20%; TEM underpredicted values by 20 to 30%, and MSDM overpredicted values by as much as a factor of 10. CEQM and TEM predicted similar peak values for 3 and 24-hour periods. Both models underpredicted by 10 to 40% for 3-hour values and by 50% for 24-hour values. No model correctly estimated the dependence of peak concentration values on distance or atmospheric stability. 31 references, 29 figures, 59 tables.

20728 **(PB—84-126978) Transportable continuous emission monitoring system operational protocol: instrumental monitoring of SO_2, NO/sub x/, CO_2, and O_2 effluent concentrations. Final report.** Peeler, J.W. (Entropy Environmentalists, Inc., Research Triangle Park, NC (USA)). Jan 1983. 62p. NTIS, PC A04/MF A01.

A transportable continuous emission monitoring system (TCEMS) capable of providing reliable and accurate effluent measurements of SO2, NO/NOx, CO2, and/or O2 has been developed and field tested at numerous industrial and utility boilers. This report presents the operational protocol for the TCEMS, including set-up, operation, calibration, quality assurance, and data reduction procedures. The TCEMS and the operational protocol are designed for use in conducting source emission tests, continuous emission monitor (CEM) relative accuracy tests, and stratification tests. Extensive field testing has shown that the TCEMS can be set up, calibrated, and recording accurate and precise data within two to four hours after arrival at the site.

20729 **(PB—84-127752) Compilation of SO_2 and NO/sub x/ continuous emission monitoring reliability information. Final report.** Peeler, J.W. (Entropy Environmentalists, Inc., Research Triangle Park, NC (USA)). Jan 1983. 38p. NTIS, PC A03/MF A01.

This report presents the latest information on the reliability of SO_2 and NOx CEM results, i.e.: (1) achievable CEM availability, (2) point-in-time CEM accuracy, and (3) the long-term capability of CEMs to provide accurate emission data.

20730 **Energetics of photosynthesis in Zea mays. II. Studies of the flash-induced electrochromic shift and fluorescence induction in mesophyll chloroplasts.** Crowther, D. (Brookhaven National Lab., Upton, NY); Leegood, R.C.; Walker, D.A.; Hind, G. *Biochimica et Biophysica Acta;* **722**: 127-136(1983).

Patterns of electron transfer in isolated mesophyll chloroplasts of maize (Zea mays L.) were studied in the presence of the physiological substrates, oxaloacetate, 3-phosphoglycerate and pyruvate. Flash-induced absorbance changes due to the electrochromic pigment band-shift (P-518) were used to estimate relative electron flow rates through the cyclic and non-cyclic pathways of electron transport. Further information on the redox state of electron carriers and the activity of coupled electron flow was obtained from measurements of fluorescence induction and of actinic-light-induced fluorescence changes. The results demonstrate the importance of correct redox poising for optimal rates of photosynthesis and are discussed in relation to the operation and regulation of photosynthesis in the C_4 system.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 20765

20731 **(DP—1675) Dispersion model for airborne radioactive particulates inside a process building.** Perkins, W.C.; Stoddard, D.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Feb 1984. Contract AC09-76SR00001. 31p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008533.

An empirical model, predicting the spread of airborne radioactive particles after they are released inside a building, has been developed. The basis for this model is a composite of data for dispersion of airborne activity recorded during 12 case incidents. These incidents occurred at the Savannah River Plant (SRP) during approximately 90 plant-years of experience with the chemical and metallurgical processing of purified neptunium and plutonium. The model illustrates that the multiple-air-zone concept, used in the designs of many nuclear facilities, can be an efficient safety feature to limit the spread of airborne activity from a release. This study also provides some insight into an apparently anomalous behavior of air-

borne particulates, namely, their migration against the prevailing flow of ventilation air. 2 references, 12 figures, 4 tables.

20732 (KEK—80-1, pp 3-19) **Model to evaluate the environmental neutron dose due to skyshine phenomenon.** Nakamura, Takashi (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Apr 1980. NTIS (US Sales Only), PC A08/MF A01. (CONF-791281—).

From 3. KEK symposium on radiation dosimetry; Oho, Ibaraki, Japan (4 Dec 1979).

The skyshine of neutrons produced upward normally from the various monoenergetic neutron sources fixed on the ground has been performed systematically by the Monte Carlo calculation. The calculated skyshine neutron spectra approach an approximate equilibrium spectrum which is close to 1/E spectrum in the KeV region, beyond about a few hundred meter far from the source. The total neutron flux PHI(r) and dose D(r) at the distance r, are well fitted to a simple formula, PHI(r) = Q/r x e sup(-r/lambda) and D(r) = Q/r x e sup(-r/lambda), and the constants, Q and lambda, are only dependent to the source neutron energy.

20733 (KHM-TR—86) **Natural radioactivity in coal.** Ericsson, S.-O. (Statens Vattenfallsverk, Vaellingby (Sweden)). May 1983. 89p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700751.

This report is a compilation of information from open literature on the occurrence of natural radioactive nuclides in coal. Special attention is given to the distribution of these nuclides on the different streams leaving coal-fired plants in relation to combustion technology and flue-gas cleaning. Different calculations of resulting doses to orifical group as well as collective dose commitment are compiled. The conclusion to be made is that coal in general contains less natural activity than ordinary soil and rock. The doses caused by modern plants are indeed very small and it is possible that the use of coal results in a certain, though insignificant, reduction of doses, calculated as collective dose commitment through the Suess-effect. Combustion of coal releases CO_2 free of carbon-14 into the atmosphere, which results in a somewhat lower activity of carbon-14 in living organisms. People, who live in the vicinity of a large coalfired plant and eat locally produced food, could get a dose of about 10^{-6} Sv/year, due to the occurence of natural radioactive nuclides in coals. This is approximately the same dose that is caused by some hours exposure to a typical concentration of radon daughters in the air in Swedish homes. Estimates of this kind are very inaccurate. In the literatur values have been found from 10^{-7} to above 10^{-4} Sv/year, depending on the assumptions made by the various authors. The radiation in dwellings, today, in Sweden have been estimated to give 7 times 10^{-3} Sv per year and person. The conclusion to be made from this literature review, is that modern coal technology will only give a neglible increase in doses. This is in accordance with conclusion made in recent years.

20734 (NIRS-M—35, pp 146-160) **Radioactive fallout in the State of Utah. Research carried out in Europe and U.S.A.** Harley, J.H. (Department of Energy, New York (USA). Environmental Measurements Lab.). 1979. NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

The State of Utah has two problems involving the radioactive fallout from weapon tests. The first is the local fallout from the test series carried out in Nevada from 1951 to 1958. The second is the relatively high deposition of global fallout in the Salt Lake City area. Environmental Measurement Laboratory, U.S. Department of Energy, has been studying both problems. Some of the available information thus far is summarized. For the first problem (childhood leukemia reports, lawsuits against the U.S. Government, radioiodine, present status), the childhood leukemia question and the lawsuit are rendered difficult without the sound evaluation of the radiation dose received. For the second problem, a gummed film station was operated in 1952 through 1959, and a monthly deposition station has been operated since 1957.

20735 (NIRS-M—35, pp 19-30) **Release to the environment and diffusion of radioiodine in the environment, 2. Atmospheric diffusion.** Sakagami, Jiro (National Inst. of Radiological Sciences, Chiba (Japan)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Materials emitted from a stack in the atmosphere move and spread. These phenomena are well known as flow phenomenon and diffusion one. In this article, general feature of the atmospheric diffusion is described, and quantities which affect the diffusion are considered. The diffusion over complex tetrain is very difficult to treat purely theoretically, so wind tunnel experiments are usually carried out. Some details concerning these experiments are discussed. Particulate matters spread somewhat in different way compared to gaseous matters, namely falling velocity and their mobility in wind turbulence appear. The spread of these matters are discussed. Some data reported by Commettees concerning the Accident of Three Miles Island are analysed. From the point of view of diffusion, these data are not sufficiently qualified to be analysed exactly, so only some results are obtained. From the data of aerial observations some reasonable results can be deduced, but from those of ground level observations the results which differ by the order of 10^{-2} from the results can be deduced. However, the paths of the plume are not distinct and therefore, the difference of this order may be possible.

20736 (NIRS-M—35, pp 46-67) **Chemical forms of radioiodine, 2. Physical and chemical forms of radioiodine in environmental atmosphere.** Naritomi, Mitsuo (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

One of the difficulties in evaluating the dose by radioiodine intake is the difficulty due to the variability of its physical-chemical form. In fact, besides the elemental iodine (I_2) radioiodine has been found in the exhaust air of nuclear power plants as non-elementary forms such as organic iodides and hypoiodous acid (HOI). But, HOI is not yet identified directly. Moreover, as almost all the radionuclides dispersed in the air behave like aerosol, radioiodine has the property of being adsorbed on fine particles in the atmosphere. In most practical case of reactor accident, such a variety of physical-chemical form would be simplified into the main form of non-elemental iodine by a containment spray and a filtration system. Nevertheless, radioiodine intake has been evaluated by inhalation and ingestion of the elemental iodine which may be often given the highest dose, because of the lack of information on behavior of non-elemental iodine species in the environmental atmosphere. This paper discusses on physical-chemical forms of radioiodine commonly found in the accidental production and release of the nuclear power plant, and on forms in the environmental atmosphere from the planned release of radioiodine by the data measured in the vicinity of BWR plants in USA, and also on photolysis of methyl iodide.

20737 (NIRS-M—35, pp 301-319) **I--129 in the environment, 9. Some aspects associated with iodine-129.** Fukuda, Seiji (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Iodine-129 has the characteristic properties of long-life and low radiation energies. Accordingly, in considering the iodine-129 discharged to the atmosphere or the marine environment, it is important to establish a methodology for evaluating the environmental impact caused by the long-term accumulation and to develop the measuring techniques of the environmental samples having very low radioactivity. This paper presents an overall review regarding the health physics problems associated with iodine-129. The contents consist of production of iodine-129, source terms monitoring for gaseous and liquid effluents, environmental monitoring, and methods of dose assessment based on the critical pathway and the

specific activity method including the dose calculation due to a multi-compartment model.

20738 (NIRS-RSD—49, pp 5-8) **Strontium-90 and cesium-137 in rain and dry fallout; January, 1978 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout, air-borne dust, service water and fresh water, soil, sea water, sea sediment, total diet, rice, milk, vegetables, tea, fish, shellfishes and seaweed, and fresh water fishes, their sampling and treatment are described. The methods of separating Sr-90 and Cs-137 and their measurement are explained. The estimations of stable Sr, K and Ca are made by atomic absorption spectroscopy, flame spectrophotometry and potassium permanganate titration, respectively. The general plan of radioactivity survey in Japan is shown. As the environmental data, the results of Sr-90 and Cs-137 in rain and dry fallout obtained from January to March, 1978, and the locations of sampling are given. In a table, the months and locations of sampling, duration (days), precipitation (mm), and the amounts of Sr-90 and Cs-137 (mCi/km^2) are shown. The maximum values are 0.31 mCi/km^2 of Sr-90 and 0.46 mCi/km^2 of Cs-137 found in Kanazawa in February, 1978.

20739 (NIRS-RSD—49, pp 9-10) **Strontium-90 and cesium-137 in air-borne dust; October, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout, air-borne dust, service water and fresh water, soil, sea water, sea sediment, total diet, rice, milk, vegetables, tea, fish, shellfishes and seaweed, and fresh water fishes, their sampling and prior treatment are described. The methods of separating Sr-90 and Cs-137 and their measurement are explained. The estimations of stable Sr, K and Ca are made by atomic absorption spectroscopy, flame spectrophotometry and potassium permanganate titration, respectively. The general plan of radioactivity survey in Japan is shown. As the environmental data, the results of Sr-90 and Cs-137 in air-borne dust obtained from October, 1977, to March, 1978, and the locations of sampling are given. In a table, the locations of sampling, the period of sampling, the absorbed volume (m^3), and the amounts of Sr-90 and Cs-137 (10^{-3} pCi/m^3) are shown. The maximum values are 4.4 x 10^{-3} pCi/m^3 of Sr-90 and 6.0 x 10^{-3} pCi/m^3 of Cs-137 found in Okuma, Fukushima Prefecture, from October to November, 1977.

20740 (NIRS-RSD—51, pp 4-9) **Strontium-90 and cesium-137 in rain and dry fallout; from Jan. 1979 to Jun. 1979. Radioactivity survey related with environmental and dietary materials.** Dec 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout were collected monthly on the sampling trays with approximately 5000 cm^2 area, which were filled with water to 1 cm depth at the beginning of every month. The samples were filtered after Sr and Cs carriers were added, and passed through cation exchange columns at 80 ml/min. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. The methods of separating Sr-90 and Cs-137 from the sample solutions are explained, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in rain and dry fallout obtained from January to June, 1979, and the locations of sampling are given. In a table, the months and the locations of sampling, duration (days), precipitation (mm), and the amounts of Sr-90 and Cs-137 (mCi/km^2) are shown. The maximum values are 0.16 mCi/km^2 of Sr-90 and 0.22 mCi/km^2 of Cs-137 found in Fukui in February, 1979.

20741 (NIRS-RSD—51, pp 10-11) **Strontium-90 and cesium-137 airborne dust; from Oct. 1978 to June 1979. Radioactivity survey related with environmental and dietary materials.** Dec 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of air-borne dust were collected by electrostatic precipitators or filter air samplers for three months at the rate of more than 3000 m^3 a month every time. The sampling was carried out 1 to 1.5 m above the ground. To the ashed and pulverized samples, both Sr and Cs carriers were added. After the samples were heated, Sr and Cs were extracted with hydrochloric acid and water. The methods of separating Sr-90 and Cs-137 from the sample solutions are explained, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in air-borne dust obtained from October, 1978, to June, 1979, and the locations of sampling are given. In a table, the locations and the period of sampling, absorbed volume (m^3), and the amounts of Sr-90 and Cs-137 (10^{-3} pCi/m^3) are shown. The maximum values are 1.3 x 10^{-3} pCi/m^3 of Sr-90 and 1.9 x 10^{-3} pCi/m^3 of Cs-137 found in Nagasaki from April to June, 1979.

20742 (NIRS-RSD—52, pp 5-12) **Strontium-90 and cesium-137 in rain and dry fallout (for domestic program); from Jan. 1979 to Dec. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout were collected monthly on the sampling trays with approximately 5000 cm^2 area, which were filled with water to 1 cm depth at the beginning of every month. The samples were filtered after Sr and Cs carriers were added, and passed through cation exchange columns at 80 ml/min. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. The methods of separating Sr-90 and Cs-137 from the sample solutions are explained, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in rain and dry fallout obtained from January to December, 1979, and the locations of sampling are given. In a table, the months and the locations of sampling, duration (days), precipitation (mm), and the amounts of Sr-90 and Cs-137 (mCi/km^2) are shown. The maximum values are 0.16 mCi/km^2 of Sr-90 and 0.22 mCi/km^2 of Cs-137 found in Fukui in February, 1979.

20743 (NIRS-RSD—52, pp 13-16) **Strontium-90 and cesium-137 in rain and dry fallout (for WHO program); from Jan. 1979 to Dec. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout were collected monthly on the sampling trays with approximately 5000 cm^2 area, which were filled with water to 1 cm depth at the beginning of every month. The samples were filtered after Sr and Cs carriers were added, and passed through cation exchange columns at 80 ml/min. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. The methods of separating Sr-90 and Cs-137 from the sample solutions are explained, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in rain and dry fallout obtained from January to December, 1979, and the locations of sampling are given. In a table, the months and the locations of sampling, duration (days), precipitation (mm), and the amounts of Sr-90 and Cs-137 (mCi/km^2) are shown. The maximum values are 0.12 mCi/km^2 of Sr-90 and 0.19 mCi/km^2 of Cs-137 found in Kanazawa in February, 1979.

20744 (NIRS-RSD—52, pp 17-18) **Strontium-90 and cesium-137 in airborne dust; from Nov. 1978 to Jul. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of air-borne dust were collected by electrostatic precipitators or filter air samplers for three months at the rate of more than 3000 m^3 a month every time. The sampling was carried out 1 to 1.5 m above the ground. The ashed and pulverized samples

were sieved, and both Sr and Cs carriers were added to them. After the samples were heated, Sr and Cs were extracted with hydrochloric acid and water. The methods of separating Sr-90 and Cs-137 from the sample solutions are explained, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in air-borne dust obtained from November, 1978, to July, 1979, and the locations of sampling are given. In a table, the locations and the period of sampling, absorbed volume (m^3), and the amounts of Sr-90 and Cs-137 (10^{-3} pCi/m^3) are shown. The maximum values are 1.3 x 10^{-3} pCi/m^3 of Sr-90 and 1.9 x 10^{-3} pCi/m^3 of Cs-137 found in Nagasaki from April to June, 1979.

20745 (NIRS-RSD—53, pp 5-9) **Strontium-90 and cesium-137 in rain and dry fallout (for domestic program); from Jan. 1980 to Jul. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout were collected monthly on the sampling trays with approximately 5000 cm^2 area, which were filled with water to 1 cm depth at the beginning of every month. The samples were filtered after Sr and Cs carriers were added, and passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. The methods of separating Sr-90 and Cs-137 from the sample solutions are explained, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in rain and dry fallout obtained from January to July, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, duration (days), precipitation (mm), and the amounts of Sr-90 and Cs-137 (mCi/km^2) are shown. The maximum values are 0.040 mCi/km^2 of Sr-90 and 0.066 mCi/km^2 of Cs-137 found in Tottori in January, 1980.

20746 (NIRS-RSD—53, pp 10-12) **Strontium-90 and cesium-137 in rain and dry fallout (for WHO program) from Jan. 1980 to Jul. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout were collected monthly on the sampling trays with approximately 5000 cm^2 area, which were filled with water to 1 cm depth at the beginning of every month. The samples were filtered after Sr and Cs carriers were added, and passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in rain and dry fallout obtained from January to July, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, duration (days), precipitation (mm), and the amounts of Sr-90 and Cs-137 (mCi/km^2) are shown. The maximum values are 0.036 mCi/km^2 of Sr-90 and 0.056 mCi/km^2 of Cs-137 found in Kochi in April, 1980.

20747 (NIRS-RSD—53, pp 13-14) **Strontium-90 and cesium-137 in airborne dust; from Oct. 1979 to Jun. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of air-borne dust were collected by electrostatic precipitators or filter air samplers for three months at the rate of more than 3000 m^3 a month every time. The sampling was carried out 1 to 1.5 m above the ground. The ashed and pulverized samples were sieved, and both Sr and Cs carriers were added to them. After the samples were heated, Sr and Cs were extracted with hydrochloric acid and water. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in air-borne dust obtained from October, 1979, to June, 1980, and the locations of sampling are given. In a table, the locations and the period of sampling, absorbed volume (m^3), and the amounts of Sr-90 and Cs-137 (10^{-3} pCi/m^3) are shown. The maximum values are 0.6 x 10^{-3} pCi/m^3 of Sr-90 and 0.9 x 10^{-3} pCi/m^3 of Cs-137 found in Niigata in April-June, 1980.

20748 (NIRS-RSD—54, pp 5-9) **Strontium-90 and cesium-137 in rain and dry fallout (for domestic program); from June 1980 to Dec. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout were collected monthly on the sampling trays with approximately 5000 cm^2 area, which were filled with water to 1 cm depth at the beginning of every month. The samples were filtered after Sr and Cs carriers were added, and passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in rain and dry fallout obtained from June to December, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, duration (days), precipitation (mm), and the amounts of Sr-90 and Cs-137 (mCi/km^2) are shown. The maximum values are 0.059 mCi/km^2 of Sr-90 and 0.089 mCi/km^2 of Cs-137 found in Fukui in December, 1980.

20749 (NIRS-RSD—54, pp 10-12) **Strontium-90 and cesium-137 in rain and dry fallout (for WHO program); from Dec. 1979 to Dec. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout were collected monthly on the sampling trays with approximately 5000 cm^2 area, which were filled with water to 1 cm depth at the beginning of every month. The samples were filtered after Sr and Cs carriers were added, and passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in rain and dry fallout obtained from December, 1979, to December, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, duration (days), precipitation (mm), and the amounts of Sr-90 and Cs-137 (mCi/km^2) are shown. The maximum values are 0.045 mCi/km^2 of Sr-90 and 0.051 mCi/km^2 of Cs-137 found in Kanazawa in December, 1980.

20750 (NIRS-RSD—54, pp 13-14) **Strontium-90 and cesium-137 in airborne dust; from April 1980 to Sept. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of air-borne dust were collected by electrostatic precipitators or filter air samplers for three months at the rate of more than 3000 m^3 a month every time. The sampling was carried out 1 to 1.5 m above the ground. The ashed and pulverized samples were sieved, and both Sr and Cs carriers were added to them. After the samples were heated, Sr and Cs were extracted with hydrochloric acid and water. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficien-

cy, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in air-borne dust obtained from April to September, 1980, and the locations of sampling are given. In a table, the locations and the period of sampling, absorbed volume (m^3), and the amounts of Sr-90 and Cs-137 (10^{-3} pCi/m^3) are shown. The maximum values are 0.4 x 10^{-3} pCi/m^3 of Sr-90 and 0.8 x 10^{-3} pCi/m^3 of Cs-137 found in Nagasaki in April-June, 1980.

20751 **(PB—84-123124) Study of environmental electromagnetic radiation levels. Serial No. 4.** Wang, J.C.H. (Federal Communications Commission, Washington, DC (USA). Office of Science and Technology). 5 Dec 1977. 18p. NTIS, PC A02/MF A01.

The purpose of this technical memorandum is to summarize some FCC work in evaluation of environmental electromagnetic radiation levels in selected cases and to serve as a contribution to the continuing comprehensive study of the electromagnetic environment. Calculations and measurement data, if available, are presented.

20752 **(PEL—283) Environmental radioactivity at the National Nuclear Research Centre, Pelindaba. Report for the year 1982.** Brits, R.J.N.; Van der Westhuizen, G.S.H.; Annandale, J. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Jun 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700771.

The revised environmental survey program, introduced during 1970 with the emphasis on monitoring of the critical paths of exposure of the general public, was continued in 1982. Results of determinations of both gross radioactivity and individual nuclides in samples of fish and water (which are critical materials for liquid-effluent releases) from the Hartebeespoort Dam and from the Crocodile River are given and discussed. Results of ^{131}I, ^{90}Sr and gamma-spectrometric analyses of milk, the critical material for releases to the atmosphere, are presented. Results are given of regular investigations of the composition of airborne releases to the atmosphere and liquid-effluent releases to the Crocodile River, performed in order to detect other possible critical nuclides. Levels of deposited and airborne activity from nuclear-bomb tests are reported. Due to absence of fresh fallout material the levels for most fission products have fallen below the limit of detection. No environmental radioactivity due to releases from the Pelindaba site could be detected above the natural background or accumulated fallout levels. Unplanned releases of UF_6 occur sometimes. Accordingly, some of the environmental samples were also analysed for uranium. The results obtained so far do not indicate an increase in uranium levels in the environment.

20753 **(PNL—5035) US uranium mining industry: background information on economics and emissions.** Bruno, G.A.; Dirks, J.A.; Jackson, P.O.; Young, J.K. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-65RL01830. 240p. NTIS, PC A11/MF A01; GPO Dep. Order Number DE84010114.

A review of the US uranium mining industry has revealed a generally depressed industry situation. The 1982 U_3O_8 production from both open-pit and underground mines declined to 3800 and 6300 tons respectively with the underground portion representing 46% of total production. US exploration and development has continued downward in 1982. Employment in the mining and milling sectors has dropped 31% and 17% respectively in 1982. Representative forecasts were developed for reactor fuel demand and U_3O_8 production for the years 1983 and 1990. Reactor fuel demand is estimated to increase from 15,900 tons to 21,300 tons U_3O_8 respectively. U_3O_8 production, however, is estimated to decrease from 10,600 tons to 9600 tons respectively. A field examination was conducted of 29 selected underground uranium mines that represent 84% of the 1982 underground production. Data was gathered regarding population, land ownership and private property valuation. An analysis of the increased cost to production resulting from the installation of 20-meter high exhaust borehole vent stacks was conducted. An assessment was made of the current and future ^{222}Rn emission levels for a group of 27 uranium mines. It is shown that ^{222}Rn emission rates are increasing from 10 individual operating mines through 1990 by 1.2 to 3.8 times. But for the group of 27 mines as a whole, a reduction of total ^{222}Rn emissions is predicted due to 17 of the mines being shutdown and sealed. The estimated total ^{222}Rn emission rate for this group of mines will be 105 Ci/yr by year end 1983 or 70% of the 1978-79 measured rate and 124 Ci/yr by year end 1990 or 83% of the 1978-79 measured rate.

20754 **Distribution of fallout cesium-137 in Hawaii.** Cox, M.E. (Univ. of Hawaii, Honolulu); Fankhauser, B.L. *Health Physics;* **46**: No. 1, 65-71(Jan 1984). Contract AS03-79ET27023.

The concentration of ^{137}Cs was determined by γ spectrometry in soils and surface-deposited volcanic sublimates from various climatic locations on the islands of Hawaii, Oahu and Maui. A distinct pattern of higher concentrations on the wetter, windward sides of the islands and a correlation between ^{137}Cs concentration and amount of rainfall were observed, which confirm the source of the ^{137}Cs as atmospheric fallout. In the soils, the concentrations measured (to 1.93 pCi/g) are within the range reported for the continental United States and other mid-latitude locations in the northern hemisphere. In the basaltic lavas, the concentration of ^{137}Cs was found to be variable but was overall very low, and is apparently controlled by the porosity and permeability of the lavas in addition to rainfall.

5006 Regulations

REFER ALSO TO CITATION(S) 20867

20755 **(EPA—450/3-84-002) Benzene emissions from maleic anhydride plants: background information for proposal to withdraw proposed standards.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Mar 1984. 49p. NTIS, PC A03/MF A01.

On April 19, 1980, the US Environmental Protection Agency (EPA) proposed a national emission standard for hazardous air pollutants (NESHAP) (45 FR 26660) that would regulate benzene emissions from maleic anhydride plants under the authority of Section 112 of the Clean Air Act as amended. Public comments were requested on the proposal in the Federal Register publication. Thirty-five comment letters were received and twenty-three oral presentations were made at the public hearing. Comments submitted relevant to the withdrawal decision, along with responses to these comments, are summarized in this document. The summary of comments and responses serves as the basis for the proposal to withdraw the proposed standards.

20756 **(EPA—450/3-84-003) Benzene emissions from ethylbenzene/styrene plants: background information for proposal to withdraw proposed standards.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Mar 1984. 55p. NTIS, PC A04/MF A01.

The US Environmental Protection Agency (EPA), on December 18, 1980, proposed a national emission standard for hazardous air pollutants (NESHAP) (45 FR 83448) that would regulate benzene emissions from ethylbenzene/styrene (EB/S) plants under the authority of Section 112 of the Clean Air Act as amended. Public comments were requested on the proposal in the Federal Register publication. Twelve comment letters were received, and six interested parties testified at the public hearing. These comments were made by EB/S manufacturers, the Chemical Manufacturers Association (CMA), and State and Federal Government offices. Comments submitted relevant to the withdrawal decision, along with the responses to these comments, are summarized in this document. The summary of comments and responses serves as the basis for the proposal to withdraw the proposed standards.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 19646, 20724, 20725, 21136

20757 (AD-A—134788/9) Installation restoration program. Phase I. Records search, Castle AFB, California. Final report. (Engineering-Science, Inc., Atlanta, GA (USA)). Oct 1983. 277p. NTIS, PC A13/MF A01.

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Confirmation and Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Castle AFB with funds provided by the Strategic Air Command (SAC).

20758 (DOE/ER/60104—3) Assessment of temporal dynamics of selected terrestrial carbon pools. Final report. Armentano, T.V.; Loucks, O.L.; Menges, E.S.; Molofsky, J.; Lawler, D.J. (Butler Univ., Indianapolis, IN (USA). Holcomb Research Inst.). Mar 1984. Contract AC02-82ER60104. 208p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84009850.

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Because the annual uptake and release of CO_2 by the earth's biota (50 to 100 Gt/yr) is 10 to 20 times larger than the recent annual combustion of fossil fuel (5 Gt/yr), understanding the global carbon cycle requires detailed consideration of modest alterations in regional photosynthesis or in the oxidation of carbon stored in the major biological pools. An original synthesis of data on wetland carbon sinks and releases, and on trends in the use of biological carbon stocks for energy is presented. These results, together with a parallel synthesis of changes in standing forest stocks, indicate that the biosphere has shifted in the past few decades from probably serving as an appreciable sink for CO_2 to being neutral with respect to CO_2 release or uptake. The trend, however, appears to be in the direction of increased CO_2 release. 334 references, 12 figures, 23 tables.

20759 (PB—84-123637) Mobile system for extracting spilled hazardous materials from excavated soils. Final report Dec 76-Apr 82. Scholz, R.; Milanowski, J. (Rexnord, Inc., Milwaukee, WI (USA)). Oct 1983. 93p. NTIS, PC A05/MF A01.

Laboratory tests were conducted with three separate pollutants (phenol, arsenic trioxide, and polychlorinated biphenyls (PCB's) and two soils of widely different characteristics (sand/gravel/silt/clay and organic loam) to evaluate techniques for cleansing soil contaminated with released or spilled hazardous materials. The tests show that scrubbing of excavated soil on site is an efficient approach for freeing soils of certain contaminants but that the effectiveness depends on the washing fluid (water + additives) and on the soil composition and particle size distribution. Based on the test results, a full-scale, field-use system was designed, engineered, fabricated, assembled, and briefly tested; the unit is now ready for field demonstrations.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 19757, 19769, 19770, 19778, 19793, 19801, 19814, 19815, 19816, 19817, 20065, 20145, 20711, 20738, 20739, 20740, 20741, 20742, 20743, 20744, 20745, 20746, 20747, 20748, 20749, 20750, 20752, 20754, 21107

20760 (ABCC—02-62) Residual radiation in Hiroshima and Nagasaki. Arakawa, E.T. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Feb 1962. Contract AC01-76EV03081. 25p. (JA and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008078.

These results show that the fission product fallout and neutron-induced radioactive isotopes can be separated very conveniently by locations in the city, i.e., the fallout occurred in the Koi-Takasu area of Hiroshima and the Nishiyama area of Nagasaki with negligible fallout in the hypocenter area. The activity in the hypocenter areas of both cities can be accounted for as due principally to neutron induced radioactive isotopes. The maximum exposure from fallout in Hiroshima is considered to have been a few r and in Nagasaki approximately 30 r. From one hour to infinite time after the detonations, the maximum possible neutron induced radiation exposure dose at the hypocenter in Hiroshima is estimated to be in the range from 183 r to 24 r, depending upon the method of calculation. Method III, which yileds 24 r appears to be subject to the least number of uncertainties and thus is the most reliable figure. The excellent agreement between these calculations and the measured activities also further supports the soundness of Method III. This method gives 4 r as the infinity dose at the hypocenter in Nagasaki. These values are considered to be of such loss magnitude as to be of negligible consequence. It should also be emphasized that even for the calculation which yields a maximum dose of 183 r, the probability of an individual being exposed to this dose is very small. These facts suggest that after the detonations in Hiroshima and Nagasaki radiation levels were such that very few individuals, if any, received significant amounts of residual radiation from external sources. 17 references, 4 figures, 3 tables.

20761 (DOE/NV/10162—14) Radionuclide Inventory and Distribution Program: the Galileo area. McArthur, R.D.; Kordas, J.F. (Nevada Univ., Las Vegas (USA). Desert Research Inst.; Lawrence Livermore National Lab., CA (USA)). 28 Dec 1983. Contract AC08-81NV10162. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84010238.

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The Galileo area is the first region of the Nevada Test Site to be surveyed by the Radionuclide Inventory and Distribution Program (RIDP). This report describes in detail the use of soil sampling and in situ spectrometry to estimate radionuclide activities at selected sampling locations; the descriptions of these methods will be used as a reference for future RIDP reports. The data collected at Galileo were analyzed by kriging and the polygons of influence method to estimate the total inventory and the distribution of six man-made radionuclides. The results of the different statistical methods agree fairly well, although the data did not give very good estimates of the variogram for kriging, and further study showed the results of kriging to be highly dependent on the variogram parameters. The results also showed that in situ spectrometry gives better estimates of radionuclide activity than soil sampling, which tends to miss highly radioactive particles associated with vegetation. 18 references, 28 figures, 11 tables.

20762 (EGG—10282-1001) Aerial radiological survey of the Oak Ridge Reservation, Oak Ridge, Tennessee. Date of survey: June 1980. (EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.). Jan 1984. Contract AC08-83NV10282. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009667.

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An aerial radiological survey of the Oak Ridge Reservation was conducted during June 1980. The survey consisted of airborne measurements of both natural and man-made gamma radiation from the terrain surface in and around the Oak Ridge Reservation. These

measurements allowed a determination of the terrestrial spatial distribution of isotopic concentrations and equivalent gamma ray exposure rates from ^{60}Co, /sup 234m/Pa, and ^{137}Cs. The results are reported as isopleths for the isotopes and are superimposed on scaled maps of the area. Gamma ray energy spectra are also presented for the net man-made radioelements. This was the third aerial radiological survey of the entire Oak Ridge Reservation. The earlier surveys were conducted in 1973 and 1974. All areas of man-made activity were in the same location as indicated by the results of the earlier surveys. It appears that no detectable new man-made activity has been released in the survey area since the 1973 and 1974 surveys. 3 references, 30 figures, 5 tables.

20763 **(EGG—10282-1026) Aerial radiological survey of the Turkey Point Plant and surrounding area, Florida City, Florida. Date of survey: March 1983.** (EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.). Oct 1983. Contract AC08-83NV10282. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009670.

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The aerial survey of the Turkey Point Plant covered a 140-square-kilometer (55-square-mile) area that included the reactor facility and an area of cooling channels located immediately south of the reactor facilities. The reactor and cooling channels were on the eastern edge of the survey area. The survey was conducted during the period 18 to 26 March 1983. Inferred exposure rates, except over the site, were due primarily to naturally occurring gamma ray emitting radionuclides and cosmic ray activity (estimated at 3.1 μR/h). The exposure rates varied from 3 to 6 μR/h in background areas; the most frequently occurring range was 3 to 4 μR/h. The maximum inferred exposure rate over the site was 140 μR/h. Spectral analysis revealed cobalt-60 as the primary contributor to the elevated exposure rate over the reactor facilities. Results of ground-based measurements taken at four locations within the survey area were consistent with the aerial data. Data collected during this survey were also consistent with results from a previous survey conducted in April 1972. 3 references, 8 figures, 3 tables.

20764 **(EML—421) ^{99}Tc vegetation reference material.** Feiner, M.S. (USDOE Environmental Measurements Lab., New York). Mar 1984. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009787.

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For the past several years participants at the Oak Ridge National Laboratory - Department of Energy Conference on Analytical Chemistry in Energy Technology discussed the need for environmental standards/reference materials for ^{99}Tc. Past efforts at interlaboratory comparisons of soil, water and vegetation samples for ^{99}Tc have been unsuccessful. At the urging of many of our colleagues, the Environmental Measurements Laboratory agreed to prepare a ^{99}Tc vegetation reference material. The sample preparation and the interlaboratory comparison to establish the ^{99}Tc reference value of 6.55 +- 0.22 pCi/g are described in this report.

20765 **(EML—424) Graphic presentation of quarterly ^{90}Sr fallout data, 1954-1982.** Larsen, R.J. (USDOE Environmental Measurements Lab., New York). Jan 1984. 188p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84009313.

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This report graphically presents all of the precipitation and ^{90}Sr deposition data for all stations operated as part of the Environmental Measurements Laboratory's (EML) global fallout program since the initiation of the program in 1954. 3 references, 179 figures.

20766 (NIRS-M—35, pp 91-106) **Transfer of radioiodine from the environment to animals and plants, (2). From soil to plant.** Yuita, Kouichi (National Inst. of Agricultural Sciences, Yatabe, Ibaraki (Japan)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Absorption rate of radioiodine by soils is influenced by the chemical forms of iodine, soil moisture conditions and pH. i.e., the absorption rate of I^- is higher than IO_3^-, and under the acidic and wet conditions, the absorption rate increases. Soil constituents such as iron and aluminium oxides, amorphous clay minerals as allophane, and organic matter play important roles in absorption of iodine by scils. Japanese soils have a high ability of iodine absorption because soil reaction is acidic, soil moisture percent is maintained at high levels throughout most of the year, and moreover the constituents of Japanese soils are frequently more suited to absorption. Iodine accumulated in the soil is scarcely solubilized under the upland water condition. But when the soil is submerged or dried, especially submerged, the solubility of soil iodine increases by factors of ten thousand or more as compared with the upland water condition. In proportion to the increase of iodine concentration in the soil solution, the amounts of iodine absorbed by plants also increase. The differences in iodine content among the plant species is very small and obscured by environmental factors such as soil moisture condition. But the differences in iodine content among the plant organs is large, i.e., average content of iodine in plant organs are as follows: leaves and stalks 0.46 > fruits 0.14 > edible roots 0.055 > grains 0.0039 ppm. Though the chemical forms of iodine in plants are still not clearly defined, small amounts of them associate with the proteins of all plants.

20767 (NIRS-M—35, pp 71-81) **Deposition of gaseous iodine onto plant leaves. Transfer of radioiodine from the environment to animals and plants.** Ohmomo, Yoichiro (National Inst. of Radiological Sciences, Nakaminato, Ibaraki (Japan). Nakaminato Lab. Branch Office). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

This parameter is dependent on the meteorological conditions, the physical conditions of the plant, and chemical state of iodine in the air. Methyliodide and elemental or molecular iodine are the possible chemical forms of iodine in the air. It is well-known that the gaseous elemental iodine is more readily and more adsorbed by vegetation than the methyliodide. And a considerable research has been conducted on those foliar uptake. However, there are few papers discussing the mechanism of those foliar uptake. Exposure experiment was conducted using a specially designed exposure chamber. Though the apparatus was made for radiological use, the experiment was carried out with stable iodine to reduce the chances of radioactive contamination and also to check the deposition of iodine immediately after exposure. Tradescantia, Tradescantia ohiensis, was used. There are four or five clusters on one stem of the plant. Half of them were covered with polyethylene film to avoid direct deposition onto the surface of the clusters. The other half were uncovered. Exposure was carried out for 3 and 6 hours under the conditions of light and darkness. Results obtained are summarized following; 1) Methyliodide is mainly taken up through stomata. 2) Elemental iodine is taken not only through stomata but also by direct deposition. 3) The accumulation of I_2 by direct deposition is about 2 items higher than that through stomata. 4) The iodine directly deposited onto the leaf surface scarcely moves to the other parts of the plant. This suggests that the iodine chemically combined with the constituent of the leaf surface.

20768 (NIRS-M—35, pp 82-88) **From pasture grass to cattle milk. Transfer of radioiodine from the environment to animals and plants, 1.** Miyamoto, Susumu (National Inst. of Animal Industry, Chiba (Japan)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Iodine-131 is one of the important fission products since it is selectively accumulated in the thyroid gland of man. The transfer of this isotope from contaminated grass to cows' milk is therefore of particular importance since milk is a major constituent of the diet especially for infants. The purpose of this paper is to discuss the transfer rate of this isotope from grass to milk of lactuating cows and its distribution in milk. It is said that the orally administered iodide is rapidly absorbed through the rumen wall and excreted mainly to urine. The absorbed iodine is accumulated highly in the thyroid gland and the considerable amount is secreted to milk. Garner et al. showed that about 5% of a dose of ^{131}I was found in

the milk within 7 days. The extremes were 1.43 to 16.4%. Present author obtained that 18 - 30% of the dosed ^{131}I was secreted into milk within 7 days, indicating somewhat higher transfer rate than that of Garner et al. It was reported that more than 90% of ^{131}I was found in milk serum in the ionic form. The countermeasures for diminishing ^{131}I in milk were also presented.

20769 (NIRS-M—35, pp 135-145) **Radioiodine in the environment. Research carried out in Europe and U.S.A.** Grauby, A.; Saas, A. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

An experimental procedure was developed in order to follow the pathways of radioiodine, ^{129}I especially, through the various compartments of nuclear plant environment: atmosphere, soil, plants, precipitations, ... A partial evaluation of the results is made. Data are supplied on iodine transfer into soil, iodine distribution one year later, release of iodine at the level of soil and plants. The intake of various forms of iodine in a soil and the evaluation of availability to plants by chemical tests showed that radioactive iodine (^{125}I) reached equilibrium with stable iodine after 120 - 140 days of incubation. During this time, there was a large amount of iodine exchangeable against a KI solution N/10. Equilibrium was reached progressively by iodine transfer on soil organic molecules. According to the origin of contamination, the transfer was more or less fast and differences were especially noticed in volatile iodine release and on chemical mobility. During intake, potential hazard of soil, groundwater, plant and atmospheric contaminations was greater. Iodine-129 is presently one of the chief contributors to air pollution around nuclear installations because of its radioactive half-life (1.72×10^7 yr) rather than on account of the amounts released. Just as with iodine-131, it is released into the atmosphere under many chemical forms. However, ^{129}I reaches man through several food chains and not only through the air-grass-cow-milk food chain. The values of its deposition rate on soil and plants are fairly dispersed because of its changing reactivity due to its chemical instability. On account of this chemical complexity, the transfer of iodine along the air-soil-plant system was studied using ^{125}I.

20770 (NIRS-M—35, pp 233-242) **Some aspects of dose evaluation, 1. Food consumption survey of for infants in Tokai area.** Sumiya, Misako (National Inst. of Radiological Sciences, Nakaminato, Ibaraki (Japan). Nakaminato Lab. Branch Office). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Survey on leaf vegetable and milk consumptions was carried out on infants and children under school age in Tokai-mura in order to pick up critical path in relation to the release of iodine-131 into the air. In our country, cows are mostly fed on imported assorted feed. So cow's milk is not always a reflex of the atmospheric release of the nuclide. As far as this survey goes, infants are fed on mother's milk. Therefore attention must be paid to the chain of leaf vegetable-nursing mother-mother's milk-infant. It may be said that leaf vegetable should be actually a critical path for children after the weaning period. It is well-known that the transfer rate of iodine-131 to thyroid is influenced by the ingestion of stable iodine. In general, we Japanese take considerable amount of stable iodine through marine food, specifically through algae. So survey on marine food consumption was carried out in order to estimate daily intake of the nuclide. Results obtained are more than 700 μg, 1.5 mg and 2.2 mg for children of 0.5 - 1.5, 1.5 - 3 and 3 - 5 years old, respectively. It is conjectured that infants fed on mother's milk take about 200 μg of the nuclide every day.

20771 (NIRS-M—35, pp 287-298) **Monitoring of radioiodine and methods for rapid measurement, 2. Rapid determination of iodine-131 by Milk matrix method.** Kamada, Hiroshi (National Inst. of Radiological Sciences, Nakaminato, Ibaraki (Japan). Nakaminato Lab. Branch Office). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Milk is selected as an indicator or critical food in the environmental monitoring samples, and radioactive iodine as a specific critical radionuclide. Rapid determination of Iodine-131 in the milk has been developed as a standard procedure for the network of environmental radioactivity monitoring in a state of emergency. Outline of the procedure is gamma-ray spectrometry using a heavily shielded 3"diameter x 3" sodium iodide (thallium-activated) crystal as a detector, 2 liter of Marinelli Beaker for a raw milk and a multi channel pulse height analyzer for quantitative analysis of gamma spectra through the utilization of simultaneous equations. The analysis is what we call "Milk Matrix Method" introducing calibration data from the standard samples of Iodine-131, Cesium-137 and Potassium-40. They were selected experimentally, and counting data from the sample were taken into the elements of matrix of set up three simultaneous equations. Most recently detected concentration of Iodine-131 in milk was 81 pCi per liter in 20 May 1978, originated from the nuclear explosion test carried out by the People's Republic of China in 15 May 1978.

20772 (NIRS-M—39, pp 283-288) **Detection of iodine-129 in some environmental samples.** Ikeda, Nagao (Tsukuba Univ., Sakura, Ibaraki (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

The recent accumulation of the long-lived isotope of iodine, ^{129}I, which is released in the environment by the peaceful use of nuclear energy or nuclear test explosion is becoming important in the view point of the internal exposure by the low level radiation. The studies on the detection of determination of ^{129}I in environmental samples so far published are still very few. The authors tried to detect ^{129}I in some Japanese seaweeds and soil samples with the aid of the activation method by using the nuclear reaction of $^{129}I(n, \gamma)^{130}I$. The samples analysed in this work are tangle (Laminaria japonica) for daily food grown in Hidaka, Hokkaido and uncultivated soil collected in Tokai, Ibaraki Pref. As the γ-ray peak indicator for ^{130}I, cesium oxide and the aged radioisotope product of ^{131}I are also subjected to the neutron irradiation. From cesium oxide, ^{130}I is formed by the reaction of $^{133}Cs(n, \alpha)^{130}I$. An aged vial of the ^{131}I product is expected to contain very minute amounts of ^{129}I which is also produced both by the fission of uranium and neutron capture reaction of tellurium followed by β^--decay. The γ-ray spectra for the soil sample, cesium oxide and the aged ^{131}I vial are shown in Fig. 1. No appreciable peak was found for the seaweeds sample. In the γ-ray spectra for irradiated cesium oxide and the aged ^{131}I vial, several typical peaks for ^{130}I were observed. By comparing with these peaks, several small peaks which appear at around 418, 536 and 739 keV in the soil sample can be attributed to those of ^{130}I. The ^{129}I content in the soil sample is roughly estimated to be 2×10^{-10} Bq/g.

20773 (NIRS-RSD—49, pp 17-19) **Strontium-90 and cesium-137 in soil; April, 1977 to September, 1977. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout, air-borne dust, service water and fresh water, soil, sea water, sea sediment, total diet, rice, milk, vegetables, tea, fish, shellfishes and sea weed, and fresh water fishes, their sampling and prior treatment are described. The methods of separating Sr-90 and Cs-137 and their measurement are explained. The estimations of stable Sr, K and Ca are made by atomic absorption spectroscopy, flame spectrophotometry and potassium permanganate titration, respectively. The general plan of radioactivity survey in Japan is shown. As the environmental data, the results of Sr-90 and Cs-137 in soil obtained from April to September, 1977, and the locations of sampling are given. In a table, the months, the locations and the depth of sampling, air soil (%), Sr(%) and the amounts of Sr-90 and Cs-137 (pCi/kg or mCi/km^2) are shown. The maximum values are 55 mCi/km^2 of Sr-90 and 150 mCi/km^2 of Cs-137 found in Obama, Nagasaki Prefecture, in July, 1977.

20774 (NIRS-RSD—49, pp 20-21) **Strontium-90 and cesium-137 in total diet; October, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Samples should be meals to be eaten daily. Avoid meals specially prepared. One sample should consist of breakfast, lunch, supper, and snacks (tea and water are inclusive) for five persons per day. The stuff is carbonized under direct fire on a large-sized stainless plate. Take care not to raise smoke. The carbide is moved on to a porcelain dish and then ashed at 500°C in an electric oven. The results obtained from October 1977 to March 1978 were shown in a table.

20775 (NIRS-RSD—49, pp 22-23) **Strontium-90 and cesium-137 in rice; April, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Sampling is done in a producing place at the harvest and in a consuming place when new rice is put on sale. Polished rice is sampled, put on a porcelain dish, carbonized and ashed. The results obtained from April 1977 to March 1978 were shown in a table.

20776 (NIRS-RSD—49, pp 24-29) **Strontium-90 and cesium-137 in milk; October, 1977 to March, 1979. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Sampling is done both in a producing place and consuming place. In the producing place, sample is taken from raw milk, and in the consuming place, commercial milk is purchased. Milk sample is put in a stainless pan or porcelain dish. After evaporation to dryness, the stuff is carbonized and ashed. The results obtained from October 1977 to March 1979 were shown in tables.

20777 (NIRS-RSD—49, pp 30-33) **Strontium-90 and cesium-137 in vegetables; April, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Vegetable materials divide into edible herbs (green vegetable) and edible roots. In principle, spinach represents green vegetable, while Japanese radish, edible roots. Each material is washed with water to remove mud. Green vegetable gets rid of leaves and roots which are not eaten. After dried, each sample is carbonized on a stainless pan or porcelain dish. The results obtained from April 1977 to March 1978 were shown in a table.

20778 (NIRS-RSD—49, pp 34-35) **Strontium-90 and cesium-137 in tea (green tea); April, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

500 g of manufactured tea is put on a stainless pan or porcelain dish, carbonized and ashed. The results obtained from April 1977 to March 1978 were shown in a table.

20779 (NIRS-RSD—49, pp 42) **Strontium-90 and cesium-137 in powdered milk; April, 1977 to April, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Commercial milk was purchased in consuming districts. Milk sample is put in a stainless pan or porcelain dish. After evaporation to dryness, the stuff is carbonized and ashed. The results obtained from April 1977 to April 1978 were shown in a table.

20780 (NIRS-RSD—51, pp 14-15) **Strontium-90 and cesium-137 in rice; from Sept. 1978 to March 1979. Radioactivity survey related with environmental and dietary materials.** Dec 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Polished rice was collected in producing districts at the harvest and in consuming areas when new crops were first put on sale. The sample was carbonized and ashed in a porcelain dish. The results obtained from September 1978 to March 1979 were shown in a table.

20781 (NIRS-RSD—51, pp 16-18) **Strontium-90 and cesium-137 in vegetables; from April 1978 to February 1979. Radioactivity survey related with environmental and dietary materials.** Dec 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively. After removing soil, the edible part of vegetable sample was dried and carbonized in a stainless steel pan or a porcelain dish. The results obtained from April 1978 to February 1979 were shown in a table.

20782 (NIRS-RSD—51, pp 19) **Strontium-90 and cesium-137 in tea (green tea); from May 1978 to July 1978. Radioactivity survey related with environmental and dietary materials.** Dec 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Five hundred grams of manufactured green tea was collected, carbonized and ashed in a stainless steel pan or a porcelain dish. The results obtained from May 1978 to July 1978 were shown in a table.

20783 (NIRS-RSD—51, pp 26) **Strontium-90 and cesium-137 in powdered milk; from Oct. 1978 to Nov. 1978. Radioactivity survey related with environmental and dietary materials.** Dec 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonizarion and ashing. The results obtained from October 1978 to November 1978 were shown in a table.

20784 (NIRS-RSD—52, pp 23-25) **Strontium-90 and cesium-137 in soil (from Jul. 1978 to Sep. 1979). Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of soil were collected from the locations in spacious and flat areas without past disturbance on the surface caused by dust-storm, inflow and outflow due to precipitation and so on. The samples were taken from two layers of different depth, 0 - 5 cm and 5 - 20 cm. In the course of air drying, lumps were crushed by hand, and plant roots, pebbles and small gravels were removed. The air-dried soils were sieved, and heated in the presence of Sr and Cs carriers together with sodium hydroxide. Then, the samples were heated with hydrochloric acid, and Sr-90 and Cs-137 were separated from the sample solutions by the methods described. Their activities were counted with low background beta counters. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in soil obtained from July, 1978, to September, 1979, and the locations of sampliing are given. In a table, the months, locations and depth (cm) of sampling, air soil (%), Sr (%) and the amounts of Sr-90 and Cs-137 (pCi/kg, mCi/km^2) are shown. The maximum values are 66 mCi/km^2 of Sr-90 found in Tokai, Ibaraki Prefecture, in August, 1979, and 160 mCi/km^2 of Cs-137 found in Minami-takaki County, Nagasaki Prefecture, in July, 1979.

20785 (NIRS-RSD—52, pp 30-32) **Strontium-90 and cesium-137 in total diet; from Nov. 1978 to Dec. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

A full one day ordinary diet including three meals, water, tea and other in-between snacks for five persons was collected as a sample of "total diet". The sample in a large stainless steel pan was carbonized carefully by direct application of gas flame, and was transferred to a porcelain dish and then ashed at 500°C in an elec-

tric muffle furnace. The results obtained from November 1978 to December 1979 were shown in a table.

20786 (NIRS-RSD—52, pp 33-34) **Strontium-90 and cesium-137 in rice; from Dec. 1978 to Dec. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Polished rice was collected in producing districts at the harvest and in consuming areas when new crops were first put on sale. The sample was carbonized and ashed in a porcelain dish. The results obtained from December 1978 to December 1979 were shown in a table.

20787 (NIRS-RSD—52, pp 35-37) **Strontium-90 and cesium-137 in milk (producing districts for WHO program); from Nov. 1978 to Nov. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Raw milk was collected in producing districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from November 1978 to November 1979 were shown in a table.

20788 (NIRS-RSD—52, pp 38) **Strontium-90 and cesium-137 in milk (producing districts for domestic program); from Feb. 1979 to Oct. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Raw milk was collected in producing districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from February 1979 to October 1979 were shown in a table.

20789 (NIRS-RSD—52, pp 38-41) **Strontium-90 and cesium-137 in milk (consuming districts); from Oct. 1978 to Oct. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from February 1979 to October 1979 were shown in a table.

20790 (NIRS-RSD—52, pp 42) **Strontium-90 and cesium-137 in milk (powdered milk); from May 1979 to Dec. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from May 1979 to December 1979 were shown in a table.

20791 (NIRS-RSD—52, pp 42-45) **Strontium-90 and cesium-137 in vegetables; from Nov. 1978 to Dec. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively. After removing soil, the edible part of vegetable sample was dried and carbonized in a stainless steel pan or porcelain dish. The results obtained from November 1978 to December 1979 were shown in a table.

20792 (NIRS-RSD—52, pp 46) **Strontium-90 and cesium-137 in tea (Japanese tea); from May 1979 to Jun. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Five hundred grams of manufactured green tea was collected, carbonized and ashed in a stainless steel pan or a porcelain dish. The results obtained from May 1979 to June 1979 were shown in a table.

20793 (NIRS-RSD—53, pp 19-20) **Strontium-90 and cesium-137 in total diet; from Aug. 1979 to Jul. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

A full one day ordinary diet including three meals, water, tea and other in-between snacks for five persons was collected as a sample of "total diet". The sample in a large stainless steel pan was carbonized carefully by direct application of gas flame, and was transferred to a porcelain dish and then ashed at 500°C in an electric muffle furnace. The results obtained from August 1979 to July 1980 were shown in a table.

20794 (NIRS-RSD—53, pp 21-22) **Strontium-90 and cesium-137 in rice; from Oct. 1979 to Jan. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Polished rice was collected in producing districts at the harvest and in consuming areas when new crops were first put on sale. The sample was carbonized and ashed in a porcelain dish. The results obtained from October 1979 to January 1980 were shown in a table.

20795 (NIRS-RSD—53, pp 23-24) **Strontium-90 and cesium-137 in milk (producing districts for WHO program); from Aug. 1979 to Jun. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Raw milk was collected in producing districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from August 1979 to June 1980 were shown in a table.

20796 (NIRS-RSD—53, pp 25) **Strontium-90 and cesium-137 in milk (producing districts for domestic program); Feb. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Raw milk was collected in producing districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained in February 1980 were shown in a table.

20797 (NIRS-RSD—53, pp 26-27) **Strontium-90 and cesium-137 in milk (consuming districts); from Aug. 1979 to May 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from August 1979 to May 1980 were shown in a table.

20798 (NIRS-RSD—53, pp 28) **Strontium-90 and cesium-137 in milk (powdered milk). Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained in April 1980 were shown in a table.

20799 (NIRS-RSD—53, pp 28-30) **Strontium-90 and cesium-137 in vegetables; from Oct. 1979 to Mar. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively. After removing soil, the edible part of vegetable sample was dried and carbonized in a stainless steel pan or a porcelain dish. The results obtained form October 1979 to March 1980 were shown in a table.

20800 (NIRS-RSD—53, pp 31) **Strontium-90 and cesium-137 in tea (Japanese tea); from May 1980 to Jun. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Five hundred grams of manufactured green tea was collected, carbonized and ashed in a stainless steel pan or a porcelain dish. The results obtained from May 1980 to June 1980 were shown in a table.

20801 (NIRS-RSD—54, pp 26-27) **Strontium-90 and cesium-137 in total diet; from June 1980 to Dec. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

A full one day ordinary diet including three meals, water, tea and other in-between snacks for five persons was collected as a sample of "total diet". The sample in a large stainless steel pan was carbonized carefully by direct application of gas flame, and was transferred to a porcelain dish and then ashed at 500°C in an electric muffle furnace. The results obtained from June 1980 to December 1980 were shown in a table.

20802 (NIRS-RSD—54, pp 28) **Strontium-90 and cesium-137 in rice (producing districts); from Oct. 1980 to Dec. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Polished rice was collected in producing districts at the harvest. The sample was carbonized and ashed in a porcelain dish. The results obtained from October 1980 to December 1980 were shown in a table.

20803 (NIRS-RSD—54, pp 29-30) **Strontium-90 and cesium-137 in rice (consuming districts); from Sept. 1980 to Jan. 1981. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Polished rice was collected in consuming area when new crops were first put on sale. The sample was carbonized and ashed in a porcelain dish. The results obtained from September 1980 to January 1981 were shown in a table.

20804 (NIRS-RSD—54, pp 31-32) **Strontium-90 and cesium-137 in milk (producing districts for WHO program); from April 1980 to Nov. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Raw milk was collected in producing districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from April 1980 to November 1980 were shown in a table.

20805 (NIRS-RSD—54, pp 33) **Strontium-90 and cesium-137 in milk (producing districts for domestic program); from June 1980 to Oct. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Raw milk was collected in producing districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from June 1980 to October 1980 were shown in a table.

20806 (NIRS-RSD—54, pp 34-35) **Strontium-90 and cesium-137 in milk (consuming districts); from June 1980 to Oct. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained from June 1980 to October 1980 were shown in a table.

20807 (NIRS-RSD—54, pp 36) **Strontium-90 and cesium-137 in milk (powdered milk); Oct. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing. The results obtained in October 1980 were shown in a table.

20808 (NIRS-RSD—54, pp 37-38) **Strontium-90 and cesium-137 in vegetables (producing districts); from May 1980 to Dec. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively. After removing soil, the edible part of vegetable sample was dried and carbonized in a stainless steel pan or a porcelain dish. The results obtained from May 1980 to December 1980 were shown in a table.

20809 (NIRS-RSD—54, pp 39-40) **Strontium-90 and cesium-137 in vegetables (consuming districts); from April 1980 to Nov. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively. After removing soil, the edible part of vegetable sample was dried and carbonized in a stainless steel pan or a porcelain dish. The results obtained from April 1980 to November 1980 were shown in a table.

20810 **(NRPB-R—131) Radiation hazards to collectors of geological specimens containing natural radioactivity.** Dixon, D.W. (National Radiological Protection Board, Harwell (UK)). Jan 1983. 23p. HMSO, London, price Pound 2.00.

Geological specimens containing significant amounts of radioactivity are available to collectors from specialist suppliers and by collection in the UK. Radiation levels associated with radioactive samples have been measured and assumptions made about handling procedures to estimate the radiation hazards.

20811 (PNCT—831-80-01, pp 159-165) **Determination of iodine-129 in environmental samples by neutron activation analysis.** Yamato, Aiji; Katagiri, Hiromi; Nomura, Tamotsu; Kitahara, Yoshihisa (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1980. NTIS (US Sales Only), PC A09/MF A01.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Jan 1979 - Mar 1980.

As the result of recent growth of nuclear industry, ^{129}I has been released to the environment. It tends to persist there for a long duration because of its long half-life. The radiation dose received by men due to its presence must be evaluated in connection with the public dose commitment from artificial radionuclides. The neutron activation method by γ-ray spectrometry is described con-

cerning the determination of ^{129}I in environmental samples. The results indicated that the removal of foreign radioisotopes before and/or after irradiation was very important for the measurement by the high-resolution γ-spectrometers with Ge(Li) detectors, because the γ-ray from foreign elements contaminates low-level ^{129}I and other iodine isotopes. The procedure described is capable of purifying iodine from interfering elements except bromine.

20812 **(RFP—3583) Health, safety and environment laboratories. Project progress report, July-December 1982.** Williams, W.F.; Smith, L.C. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 6 Feb 1984. Contract AC04-76DP03533. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007979.

Progress is reported in research in analytical techniques for plutonium in soils, urine, and tissues; radiation measurements; and radiation instrumentation. (ACR)

20813 **(UCRL—88450) Investigation of the pathway of contaminated soil transported to plant surfaces by raindrop splash.** Dreicer, M.; Hakonson, T.E.; Whicker, F.W.; White, G.C. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA); Colorado State Univ., Fort Collins (USA)). 21 Oct 1983. Contract W-7405-ENG-48. 6p. (CONF-840512—5). NTIS, PC A02/MF A01. Order Number DE84002720.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

The environmental transport pathway of soil-borne radioisotopes to vegetation surfaces via raindrop splash was studied. The data show that soil can significantly contribute to the contamination found on plants. Further detailed study is needed to calculate the rate constant for the raindrop splash and retention pathways. 8 references, 1 figure. (ACR)

20814 **Rainsplash as a mechanism for soil contamination of plant surfaces.** Dreicer, M. (Lawrence Livermore National Lab., CA); Hakonson, T.E.; White, G.C. *Health Physics;* **46**: No. 1, 177-187(Jan 1984). Contract W-7405-ENG-36;W-7405-ENG-48.

The authors characterized the physical transport of soil, and therefore contaminants attached to the soil, onto vegetative surfaces due to rainsplash. Soil accumulation by tomato plants (Lycopersicon esculentum) was investigated as a function of soil particle size, rainstorm characteristics, foliage height, surface area and canopy cover of the plants. No soil particles greater than 105 μm in diameter were detected on the plants. Most of the soil was splashed no higher than 40 cm above the ground surface. Linear relationships were observed for concentrations of <53 μm soil on vegetation and certain rainfall characteristics. Data from this study, as well as ancillary calculations, provide evidence that a significant fraction of surficial contamination of foliage may be attributed to the rainsplash mechanism.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 19719, 19750, 19751, 19786

5106 Regulations

REFER ALSO TO CITATION(S) 20867

52 ENVIRONMENTAL SCIENCES, AQUATIC

REFER ALSO TO CITATION(S) 19646

5201 Basic Studies

REFER ALSO TO CITATION(S) 21149

20815 **(DOE/EV/01332—1) Vertebrate behavior and ecology. Final report, October 16, 1967-May 31, 1983.** Tester, J.R.; Siniff, D.B. (Minnesota Univ., Minneapolis (USA)). Feb 1984. Contract AC02-76EV01332. 29p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007318.

Radio telemetry engineering, design and development has recently focused on high power transmitters, ultrasonic receivers and transmitters, corrosive links, high frequency transmitters and implanted transmitters. Ranges from implanted transmitters are approximately 4 to 10 times less than from external transmitters due to fundamental limitations of small antennas. Social organization, movements, activities, foraging strategies, and population dynamics of sea otters (Enhydra lutris) were investigated from 1979 to 1982 in Prince William Sound, Alaska. Otters in newly occupied male areas spent 23% less time feeding but obtained 38% more calories per day than otters in the area of prolonged occupation where food was less abundant. Reduction of boat traffic during winter in most recently occupied male areas prompted large seasonal influexes of otters. Females were capable of reproducing annually, but rarely did so under food-stressed conditions. The population segment in the male areas increased at a rate of 50% per year as male pups dispersed from all parts of the Sound into this region, and few animals died.

20816 (ZfI-Mitt—69, pp 272-286) **Prediction of mixing length for the transport of effluents in rivers.** Szpilowski, S. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The studies on the evaluation of transverse mixing length of effluents discharged into natural streams have been reported. Proposed method bases on measured values of dispersion coefficients. Field tests were carried out in Vistula river nearby the city of Warsaw using ^{82}Br as a tracer. The procedure worked out can be used for prediction of mixing lenght for sewage outfall under design.

20817 (ZfI-Mitt—69, pp 287-296) **Localization of the leakages through the dams and bottoms of large water reservoirs.** Owczarczyk, A. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

/sup 113m/In generators have been used for the localization of leakages through the bottoms and dams of large water reservoirs. The field experiments were carried out, in the large storage reservoir at the Przemsza river and at the dam in Wisla-Czarne.

20818 **Inexpensive, floating, insect-emergence trap.** Cushman, R.M. (Oak Ridge National Lab., TN). *Bulletin of Environmental Contamination and Toxicology;* **31**: No. 5, 547-550(Nov 1983). Contract W-7405-ENG-26.

The Environmental Sciences Division of Oak Ridge National Laboratory has been investigating the usefulness of aquarium microcosms and ponds for the quantification and predictions of toxicant effects on freshwater systems. Ideally, concepts and methods applicable to both 150-L microcosms and 15,000-L ponds would bridge the gap between the two. The effort of processing the benthic samples, as well as the destructiveness of the sampling in

small ponds, limited the number of samples that could be taken. Therefore, the author developed an inexpensive emergence trap appropriate for use in small outdoor ponds, as one method of increasing sampling efficiency and economy. To prevent the possibility of trapping adults from adjacent ponds, which would confound the results, the traps had to be designed such that they could only trap insects from the ponds upon which they were floating. The design of this trap is described.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 19638, 19639, 19680, 19681, 19820, 19896, 20725, 20758, 20863

20819 (EPA-SW—963-Rev.) Ground-water monitoring guidance for owners and operators of interim status facilities. Revision. (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste and Emergency Response). Mar 1983. 190p. NTIS, PC A09/MF A01. Order Number DE84900827.

Portions are illegible in microfiche products.

This Manual provides guidance for owners and operators of hazardous waste land disposal facilities in complying with the interim status requirements for ground-water quality monitoring in Subpart F of 40 CFR 265, (45 Fed. Reg. 33239 et seq., May 19, 1980). These regulations require owners and operators to design and implement either a detection program at facilities not known or assumed to be significantly affecting ground-water quality or an assessment program for quantifying the ground water quality effects which have occurred. Owners or operators who assumed that ground water has been affected by the facility were provided an opportunity to waive the detection program. In this case, they may enter directly into the assessment program, quantifying the extent of contamination and the rate of migration. This manual discusses the objectives of the programs, the regulatory language and the Agency's associated intent, and required monitoring systems, analyses and reporting. The guidance in this manual is applicable to EPA-administered programs.

20820 (NP—4770190) ARW annual report '82. (Arbeitsgemeinschaft Wasserwerke Bodensee-Rhein, Karlsruhe (Germany, F.R.)). 1982. 185p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770190.

Portions are illegible in microfiche products.

The annual report presents a map of the ARW service region for Rhine and Main water and the chairman's report. He states that more special sampling studies could be made this last year with improved technical equipment. These studies have shown considerable variations in pollutant concentrations which cannot be explained otherwise than as a result of batch discharge of pollutant emissions in the course of analogous production processes. Results of water analyses are presented, e.g. concentrations of organic trace elements or organic micro-impurities.

20821 (PB—84-122985) Draft environmental impact statement for metropolitan wastewater management commission sludge management plan Eugene-Springfield, Oregon. (Jones and Stokes Associates, Inc., Sacramento, CA (USA)). Oct 1983. 306p. NTIS, PC A14/MF A01.

The Metropolitan Wastewater Management Commission (MWMC) has received a grant from the Environmental Protection Agency (EPA) to prepare a 20-year Sludge Management Plan for the treatment and disposal of sludge generated at a new regional sewage treatment plant. The regional plant is under construction and will begin operation in 1984. It will serve both the Eugene and Springfield, Oregon, metropolitan areas. MWMC proposed an interim plan, Phase I, that would provide five years of sludge handling capability on the treatment plant site because startup of the new plant depended upon immediate handling facilities for increased sludge volumes. EPA issued a Finding of No Significant Impact on Phase I of the plan in June, 1983. The Draft Environmental Impact Statement evaluates Phase II of the MWMC Sludge Management Plan. MWMC's preferred alternative for Phase II is to move the sludge handling facilities off site. Treatment and storage lagoons would store sludge in winter; sludge would be applied to farmlands in summer. This document evaluates four alternatives and three sites, including MWMC's preferred alternative. It identifies and evaluates potential impacts of the alternatives to geology, soils, public health, surface and groundwater quality, land use, vegetation and crops, terrestrial wildlife and aquatic life. Recommended mitigation measures are also discussed.

20822 (PB—84-126770) Assessment for future environmental problems - ocean dumping. Final report. Menzie, C.A.; Babin, F.; Cura, J.; Mariani, G. (EG and G, Inc., Waltham, MA (USA). Environmental Consultants Div.). Dec 1983. 160p. NTIS, PC A08/MF A01.

The objective of this report is to provide the U.S. Environmental Protection Agency's Office of Strategic Assessment and Special Studies with a technical basis for making decisions on research priorities and resource allocation as these relate to the question of ocean dumping. The program was organized into four tasks. First, historical trends in waste generation, disposal, and legislative and technological factors (as of 1982) were reviewed to indicate the likeihood that a particular waste type would be ocean dumped in the future. Second, the environmental implications of land-based alternatives were reviewed to provide background on the nature of risks associated with these alternatives. Third, the environmental implications of ocean disposal were reviewed for wastes and their constituents. Finally, based on the information generated in the first three tasks, recommendations are provided on future research needs and these are assigned either high, moderate, or low priority status.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 19769, 19811, 19812, 19813, 19815, 19816, 19823, 19826, 20067, 20547, 20737, 20738, 20739, 20740, 20741, 20742, 20743, 20744, 20745, 20746, 20747, 20748, 20749, 20750, 20752, 21108, 21109, 21111, 21146, 21147, 21148, 21158

20823 (IAEA-R—1825-F) Measurement of the present activity concentration in the water of the Danube river (determination of Sr 89, Sr 90 and Cs 137 and gamma spectroscopy). Coordinated programme on radiological and environmental protection studies in the Danube river catchment area. Final report for the period 15 July 1976-31 October 1982. Tschurlovits, M. (International Atomic Energy Agency, Vienna (Austria)). Jul 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700766.

A monitoring system was developed which fulfills, as a compromise, a number of requirements. These are: sufficient sensitivity to assess the per caput and collective dose from water use in the Danube river; reasonable effort to carry out these measurements. The dose results mainly from natural radionuclides, although artificial radionuclides were also detected, and found to be more than two magnitudes lower than the natural external background. The origin of the artificial radionuclides was identified clearly as to be from nuclear fallout, although NPP were at least partly in operation upstream in the investigation period. This conclusion is proved by clear seasonal effects and simple constraints, e.g., the low activity actually released by NPP. The system can also be useful for assessment of radioecological parameters, e.g., the concentration of radionuclides in fish.

20824 (IAEA-R—2234-F) Determination of groundwater characteristics and water budget in the Edremit Plain by means of isotopes. Final report for the period 15 December 1978 - 14 March 1982. Onhon, E. (International Atomic Energy Agency, Vienna (Austria)). Aug 1983. 76p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700752.

Detailed field investigations with environmental isotopes (O-18, D, T, C-14 and C-13) have been conducted to study the replenishment process and flow dynamics of groundwater system in Edremit plain, which is an area of 200 m^2 size located in the eastern part of Turkey. Along with conventional hydrogeological and hydrochemical data collected from the study area, results of environmental isotopic analyses performed on water samples systematically collected from the area, enabled to delineate the source and origin of recharge to the shallow groundwater aquifers and as well provided

information on various dynamic parameters of groundwater flow. In addition to basic flow dynamic characteristics of the shallow aquifer in the study area, environmental isotopes were used to investigate the hydraulic interconnections between deeper thermal groundwater system and the upper shallow aquifers. Results of all the environmental isotopic analyses and their interpretation are given.

20825 **(IAEA-R—2493-F) Groundwater dating intercomparison: uranium isotopes and ^{4}He methods. Part of a coordinated programme on application of environmental isotope techniques of groundwater problems. Final report for the period 15 December 1979 - 14 February 1983.** Andrews, J.N. (International Atomic Energy Agency, Vienna (Austria)). Apr 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700753.

Under coordinated research programme on comparison of groundwater "dating" methods water samples from two study areas have been analysed for dissolved radionuclides ^{222}Rn, ^{226}Ra, ^{238}U and ^{234}U/^{238}U activity ratio. Concentration of inert gases He, Ne, Ar, Kr, Xe has been measured and recharged temperature of groundwater has been estimated. The amount of ^{4}He found in groundwater samples was much higher than expected from the aquifer matrix and groundwater residence times. The source of additional ^{4}He has not been positively identified. The ^{234}U/^{238}U activity ratio variations do not follow any regular pattern which would allow the deduction of groundwater residence times.

20826 **(IAEA-R—3094-F) Research within the coordinated programme on comparison of methods for "age" determination of groundwater based on decay of long-lived radioisotopes. Final report for the period 15 February 1982 - 14 February 1983.** Calf, G.E. (International Atomic Energy Agency, Vienna (Austria)). Mar 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700754.

Environmental Chlorine-36 has been used to attempt dating of groundwater in Great Artesian Basin in Australia. Liquid scintillation technique has been used for preliminary estimation of presence of Cl-36. Final measurements of Cl-36 concentration shall be done by tandem accelerator of the University of Arizona.

20827 **(IAEA-TECDOC—274) Modelling of hydrodynamic mechanisms of pollutant propagation in coastal zones.** Benque, J.P.; Nihoul, J.C.J. (International Atomic Energy Agency, Vienna (Austria)). Nov 1982. 104p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700755.

The results of this document have to be distinguished in mathematical models applicable to small-area problems (horizontal scale comparable to depth) and models applicable to large-area phenomena (horizontal scales much greater than depth, quasi-hydrostatic approximation). In the case of the former, progress remains to be made in the simulation of turbulence and in the development of algorithms applicable under often very complex geometrical conditions. Excellent results are obtained by combining mathematical models with reduced-scale models, the former (on larger scales) providing the boundary conditions for the tank of the physical models. Large-area problems can be tackled only by means of mathematical models. These models are extremely efficient for the calculation of mesoscale circulation and transport of pollutants, but they all run into the same difficulty of simulating long-term problems and of determining drift currents. The principal difficulty faced by mesoscale or macroscale models is the determination of atmospheric conditions and of boundary conditions in the open sea. Mathematical models make it possible to determine the situation at every point of a given coastal zone and require only the conditions at the boundaries of the zone for this purpose. However, although these conditions at the boundary correspond to an experimental effort small in relation to total surveillance of the zone, they are essential to the predictions of the mathematical model, and efforts must be made to obtain the best possible boundary conditions. In addition to these experimental surveys at the boundaries, a certain number of observations within the zone are needed for the calibration of the model, i.e. for the determination of certain numerical coefficients appearing in the parametrization.

20828 (IAEA-TECDOC—291, pp 123-130) **Use of tracers for studying leaks in reservoirs.** Guizerix, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

The tracer methods for localization of leaks in water reservoirs are: method of free migration of tracer; method of confinement of tracer; method of direct labelling of the infiltration zone. Combination of these methods allow for localization and the type of leak in water reservoir. The mostly used radioactive tracer is ^{131}I but in some cases also the fluorescent tracers can be used.

20829 (NIRS-M—35, pp 119-132) **From sea water to marine organisms; transfer to marine organisms. Transfer of Radioiodine from the environment to animals and plants, 2.** Koyanagi, Taku (National Inst. of Radiological Sciences, Nakaminato, Ibaraki (Japan). Nakaminato Lab. Branch Office). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

As a study on transfer of radioiodine to marine organisms, accumulation and excretion of radioiodine by five species of marine fishes were observed by the aquarium experiments using Na^{131}I as the tracer. Transfer of radioiodine to the fishes was examined on three different pathways, via seawater, sediment, and food. Concentration of radioiodine in organs of tissues of sea bass, Lateolabrax japonics, yellow tail, Seriola quinqueradiata, and rock fish, Sebastes nivosus, reared in labeled seawater reached maximum within five to ten days and decreased thereafter. Concentration factors calculated at the fifth day of breeding showed the highest value in gall-bladder followed by gut-content suggesting the secretion of bile into the intestine. Loss of radioactivity from the fishes showed two components elimination patterns and biological half-lives were calculated as 2.8 days and 53.5 days, respectively, in muscle of sea bass, for example. Sediment-bound radioiodine administered to benthic fish, right-eye flounder, Kareius bicoloratus, was lost rapidly after the administration but about ten per cent of the whole-body radioactivity were retained by the fishes after the excretion of sediment and eliminated with longer half-lives comparable to those taken up from seawater. Distribution of radioiodine among organs or tissues of the flounder was different between the fishes before and after the elimination experiment showing rapid loss from gill and slower elimination from liver or muscle. Radioiodine administered to sea bream, Pagrus major, as labeled anchovy was climinated also with two components loss processes and elimination rates were little higher than the fishes administered radioiodine as solution in gelatine capsules. Higher distribution of radioiodine in gill of the sea bream suggested the dominant excretion of radioiodine through gill of the fishes.

20830 (NIRS-M—39, pp 15-26) **Chemical behavior of inorganic elements in seawater.** Shigeki, Hirano (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

The chemical behavior of radioactive cerium and cobalt in seawater was studied on the basis of chemical equilibrium between those elements and major anions or amino acids present in seawater. The stability constants of inorganic complexes of ^{144}Ce were determined by using ion exchange batch method with Dowex 50W-X8 and -4. The abundance ratios of ^{144}Ce was calculated with the stability constants obtained in this experiment and the most dominant species was Ce(OH)$_3$. The stability constants of ^{60}Co with major anions as well as amino acids were determined and the abundance ratios of chemical species of ^{60}Co was determined as well. A small fraction of amino-cobalt was formed in seawater and large part of ^{60}Co introduced into seawater remained in the form of inorganic complexes. Redox change of ^{125}I in the seawater was also studied. Radioactive iodine-125 was inoculated into the aquarium in which fish or seaweeds was held. Both reduction and oxidation re-

action occurred in the aquarium containing living organisms, while only oxidation reaction proceeded in the aquarium without holding living organisms.

20831 (NIRS-M—39, pp 27-35) **Oxidation state of fallout plutonium in sea water.** Yamato, Aiji (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

Chemical speciation of fallout plutonium in seawater collected at Tokaimura on the Pacific coast and at Monaco on the Mediterranian was carried out by means of a lanthanum fluoride coprecipitation method with $^{236}Pu(+4)$ and $^{242}Pu(+6)$ double tracers. Higher oxidation states (+5, +6) species were predominant compared to lower ones (+3, +4), and the amount of higher pair species was 50 – 85% of the total sup(239,240)Pu in these seawater samples. The existance of plutonium in high oxidation states may pertain the disproportionation of pentavalent plutonium which have been carried into oceans by rain.

20832 (NIRS-M—39, pp 72-88) **Metabolism of radionuclides by marine fishes.** Koyanagi, Taku (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

As one of the factors governing the biological concentration and metabolism of radionuclides by marine organisms, effect of the form of radionuclide was examined by observing the turnover rates, distribution and existing states of radiocobalt in marine fishes. Two species of marine fish, common goby, Acanthogobius flavimanus and yellow tails, Seriola quinqueradiata were each fed on juvenile anchovy, Engralis japonica and euphausia, Euphausia superba labelled with organic ^{57}Co in the form of cyanocobalamin and inorganic ^{60}Co in the form of cobalt chloride, respectively. Whole-body radioactivities of the fishes were measured periodically and distribution of the accumulated radio nuclides was observed in the dissected fishes after the excretion experiments. Binding of the radionuclides with the constituents of the fish bodies was examined by means of gel filtration chromatography (GFC) with Sephadex G-75 on some organs or tissues of the fishes. The most of radioactivity was lost quickly after the administration in the case of ^{60}Co-chloride but retention rate increased to around 30 to 40 per cent of the dose by the repeated feeding. In the case of ^{57}Co-cyanocobalamin, on the other hand, more than 60 to 90 per cent of the administered radioactivities were retained by the fishes but biological half-life of the long component in the elimination was shorter than the case of inorganic cobalt. Distribution of radioactivities among organs or tissues of the fishes was quite different between inorganic and organic cobalt showing very high distribution of the former in blood and of the latter in liver. The profiles of GFC observed on the extracts of some organs or tissues of the fishes were also different due to the form of administered cobalt and binding with two or three kinds of the proteinous substances of different molecular weight was suggested.

20833 (NIRS-M—39, pp 236-253) **Distribution of chemical elements in marine algae.** Yamamoto, Toshio (Kyoto Univ. of Education (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

The analytical data on the distribution of chemical elements in the biosphere is promptly increasing in numbers. A method of data analysis which can arrange these data in accordance with a definite principle has been proposed. In our laboratory, systematic study of chemical elements in various Japanese seaweeds has been carried out and a relationship between the concentration factor for elements on a seaweed and its oceanic residence time emerged from the results: the logarithm of the concentration factor(y) tends to be inversely proportional to the logarithm of the residence time(x). Consequently the following formula can be assumed: log y = log a + b log x. The values of log a, b, and the correlation coefficient r are calculated from the individual data. Usually the value of $^{+}r^{+}$ was more than 0.8. And in general the larger value of log a the sample has, the larger one of $^{+}b^{+}$ it has. This regularity between residence time and concentration factor was observed also in other phyla of marine organisms such as marine zoo plankton. Furthermore, since the ocean is closely connected with each of geochemical spheres, there is a tendency that the value of oceanic residence time has similar relation with the concentration ratio of many other geochemical abundance to oceanic chemical abundance as well as with concentration factor of marine organisms. In connection with these results it was found that there is close correlation between the two of each ratio of geochemical abundance to oceanic abundance. On the other hand, it was seen that there are no close correlation between ratios of geochemical abundance to crustal chemical abundance or other ones. Therefore it is again presumed that the ocean gives important contributions on the distribution of chemical elements in many kinds of substances in biosphere.

20834 (NIRS-M—39, pp 309-319) **Dependence of bioaccumulation of radioactive materials in marine organisms on their concentrations in sea water around the organisms. Discussion from the standpoint of dose assessment.** Iijima, Toshinori (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

When concentration factors in marine organisms are applied for assessment of doses due to ingestion of the radioactively contaminated organisms, concentrations of the contaminants in the sea water around the organisms should be assumed to be constant during an interested period. For such the purpose, either the maximum or the averaged concentrations are in general defined as the representative in this sea area. In the real sea, however, the concentrations always change depending on the oceanographical and/or meteorological conditions. In the present study is discussed effects of change of the concentration in the sea on accumulation in the organisms. The concentration in sea water is given as a single trigonometrical function, and the accumulating mechanisms in the organism is very simply modeled. It is concluded that, as far as such the simple models are applied, the accumulation slightly depends on the change of the concentration in sea water.

20835 (NIRS-M—39, pp 336-350) **Application of concentration factor.** Shimizu, Makoto (Tokyo Univ. (Japan). Faculty of Agriculture). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

Concentration factor is used to estimate internal dose through consumption of fish and shellfish. The amount of nuclide intake is estimated as "radioactivity in ambient water x concentration factor x consumption of fish and shellfish". These parameters involved are usually treated as constants but these actually are variables. Here the significance of their variation on dose assessment is examined. Concentration factors are varied according to various environmental as well as biological factors. For example, Hg, Cs, and As in the muscle of Galeus nipponensis increase as total length increases and, on the contrary, Cu, Zn, Fe and Co show negative correlation with total length. We should examine these cases and determine what value should be used in dose assessment. More important is to build up models to interprete these phenomena totally. Significance of variation in ambient radioactivity was examined by a simulation of nuclide accumulation in biota exposed to intermittent release and compared with that to continuous release. Variations either within a day or within a year were not shown to have much effect. On the variations in sea food consumption, several examples were given. Problem to be solved is how to consider these variations on assessing internal dose due to fish consumption. In conclusion it is necessary to get more of such kind of informations on the variations of parameters. And also we should determine the

precision of each parameter in the whole picture of dose assessment.

20836 (NIRS-M—39, pp 354-358) **Comment on the assessment of internal dose to the total body from radionuclides incorporated into sea food.** Uchiyama, Masafumi (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

In the equations to assess the dose commitment from the consumption of sea food polluted with radionuclides, the absorption of the radionuclides from the gastrointestinal tract or the fraction of the radionuclides passing from the blood to the body organ of concern and the effective half-time in the organ are included as biological parameters. After summarizing briefly the effects on the parameters from amounts of the stable isotopes, the physico-chemical states in the sea food and the time of age and the duration in which the sea-life was in contact with the radionuclide, it is emphasized that the values of parameters in the equations are not constant but variable, especially in cases of some biologically important radionuclides.

20837 (NIRS-RSD—49, pp 11-14) **Strontium-90 and cesium-137 in service water; October, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout, air-borne dust, service water and fresh water, soil, sea water, sea sediment, total diet, rice, milk, vegetables, tea, fish, shellfishes and seaweed, and fresh water fishes, their sampling and prior treatment are described. The methods of separating Sr-90 and Cs-137 and their measurement are explained. The estimations of stable Sr, K and Ca are made by atomic absorption spectroscopy, flame spectrophotometry and potassium permanganate titration, respectively. The general plan of radioactivity survey in Japan is shown. As the environmental data, the results of Sr-90 and Cs-137 in source water and tap water obtained from October, 1977, to March, 1978, and the locations of sampling are given. In a table, the months and the locations of sampling, pH, and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.33 pCi/l of Sr-90 found in Kyoto in February, 1978, and 0.02 pCi/l of Cs-137 found in Katsushika, Tokyo, and Inuyama, Aichi Prefecture, in December, 1977, in source water. In tap water, 0.35 pCi/l of Sr-90 was found in Kyoto in February, 1978, and 0.02 pCi/l of Cs-137 in Sapporo and Akita in December, 1977.

20838 (NIRS-RSD—49, pp 15-16) **Strontium-90 and cesium-137 in fresh water; April, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of rain and dry fallout, air-borne dust, service water and fresh water, soil, sea water, sea sediment, total diet, rice, milk, vegetables, tea, fish, shellfishes and seaweed, and fresh water fishes, their sampling and prior treatment are described. The methods of separating Sr-90 and Cs-137 and their measurement are explained. The estimations of stable Sr, K and Ca are made by atomic absorption spectroscopy, flame spectophotometry and potassium permanganate titration, respectively. The general plan of radioactivity survey in Japan is shown. As the environmental data, the results of Sr-90 and Cs-137 in fresh water obtained from April, 1977, to March, 1978, and the locations of sampling are given. In a table, the months and the locations of sampling, pH, and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.45 pCi/l of Sr-90 and 0.18 pCi/l of Cs-137 found in Mikata, Fukui Prefecture, in November, 1977.

20839 (NIRS-RSD—49, pp 36-39) **Strontium-90 and cesium-137 in marine products; April, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Sampling is done independently at producing places and consuming places. Kinds of products representing respective areas and places should be chosen. The results obtained from April 1977 to March 1978 were shown in a table.

20840 (NIRS-RSD—49, pp 40-41) **Strontium-90 and cesium-137 in fresh-water fish; April, 1977 to March, 1978. Radioactivity survey related with environmental and dietary materials.** Jun 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Each sample is washed in water and wiped with filter paper. Only the eatable portion is used in case of a large-sized fish, and the whole is used in case of a small fish. Each is weighed, placed on a stainless pan or porcelain dish, carbonized and further ashed in an electric oven. The results obtained from April 1977 to March 1978 were shown in a table.

20841 (NIRS-RSD—51, pp 20-23) **Strontium-90 and cesium-137 in seaweeds; from May 1978 to March 1979. Radioactivity survey related with environmental and dietary materials.** Dec 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Edible seaweeds were collected and rinsed with water to remove sand and other adhering matters on the surface. These were removed of excess water, weighed, dried and ashed. The results obtained from May 1978 to March 1979 were shown in a table.

20842 (NIRS-RSD—51, pp 24-25) **Strontium-90 and cesium-137 in freshwater fish; from July 1978 to December 1978. Radioactivity survey related with environmental and dietary materials.** Dec 1979. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Fish were rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from July 1978 to December 1978 were shown in a table.

20843 (NIRS-RSD—52, pp 28-29) **Strontium-90 and cesium-137 in sea sediments (from Apr. 1979 to Nov. 1979). Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of sea sediment were collected in the same areas as those of sea water samples, where the water depth exceeds 1 m at low tide, significant sediment movement is not observed, and mud, silt and fine sand are preferable. Conventional sediment-sampling devices were used. Approximately 4 kg wet weight of the samples were spread on large porcelain dishes, and dried in electric furnaces. After the removal of foreign matters, the sediment samples were ground, sieved, and heated in the presence of Sr and Cs carriers together with sodium hydroxide. Then, the samples were heated with hydrochloric acid. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in sea sediment obtained from April to November, 1979, and the locations of sampling are given. In a table, the months and the locations of sampling, depth (m), and the amounts of Sr-90 and Cs-137 (pCi/kg) are shown. The maximum values are 16 pCi/kg of Sr-90 and 250 pCi/kg of Cs-137 found in Mutsu Bay in August, 1979.

20844 (NIRS-RSD—52, pp 19-22) **Strontium-90 and cesium-137 in service water; from Dec. 1978 to Dec. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of service water, 1000 l each, were collected at the intakes of water treatment plants and at taps after water was left flowing out for 5 min. The carriers of Sr and Cs were added immediately after the sampling, and the samples were vigorously stirred and filtered. They were passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. The methods of separating Sr-90 and Cs-137 from the sample solutions are explained, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in service water obtained from December, 1978, to December, 1979, and the locations of sampling are given. In a table, the months and the locations of sampling, pH, and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.49 pCi/l of Sr-90 in tap water found in Wakkanai in December, 1978, and 0.04 pCi/l of Cs-137 in tap water found in Mito in May, 1979.

20845 (NIRS-RSD—52, pp 26-27) **Strontium-90 and cesium-137 in seawater; from Jul. 1979 to Nov. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of seawater were collected at the fixed stations, where the effect of terrestrial fresh water from rivers is negligibly small, when there was no rainfall for the last several days. The contamination of the samples was carefully prevented. Immediately after the collection, the samples were acidified to the pH lower than 3 with concentrated hydrochloric acid, and stored. 200 ml of seawater was also collected at the same stations for chlorinity test. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in seawater obtained from July to November, 1979, and the locations of sampling are given. In a table, the months and the locations of sampling, Cl (%), sample volume analyzed (l), and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.16 pCi/l of Sr-90 found in Osaka Bay in September, 1979, and 0.17 pCi/l of Cs-137 in odawara Bay in August, 1979.

20846 (NIRS-RSD—52, pp 47-50) **Strontium-90 and cesium-137 in sea fish; from Nov. 1978 to Jan. 1980. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Fiwas were rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from November 1978 to January 1980 were shown in a table.

20847 (NIRS-RSD—52, pp 51-52) **Strontium-90 and cesium-137 in freshwater fish; from Nov. 1978 to Dec. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Fish were rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from November 1978 to December 1979 were shown in a table.

20848 (NIRS-RSD—52, pp 53-54) **Strontium-90 and cesium-137 in shellfish; from Nov. 1978 to Nov. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Approximately 4 kg of shellfish including the shells was collected or purchased. After removing the shells, each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from November 1978 to November 1979 were shown in a table.

20849 (NIRS-RSD—52, pp 55-56) **Strontium-90 and cesium-137 in seaweeds; from Jan. 1979 to Jun. 1979. Radioactivity survey related with environmental and dietary materials.** Mar 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Edible seaweeds were collected and rinsed with water to remove sand and other adhering matters on the surface. These were removed of excess water, weighed, dried and ashed. The results obtained from January 1979 to June 1979 were shown in a table.

20850 (NIRS-RSD—53, pp 15-17) **Strontium-90 and cesium-137 in service water; from Dec. 1979 to Jun. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of service water, 100 l each, were collected at the intakes of water treatmentplants and at taps after water was left flowing out for 5 min. The carriers of Sr and Cs were added immediately after the sampling, and the samples were vigorously stirred and filtered. They were passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in service water obtained from December, 1979, to June, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, pH, and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.55 pCi/l of Sr-90 in tap water found in Wakkanai in December, 1979, and 0.05 pCi/l of Cs-137 in source water found in Katsushika, Tokyo, in December, 1979.

20851 (NIRS-RSD—53, pp 18) **Strontium-90 and cesium-137 in freshwater; from Nov. 1979 to May 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

The samples of fresh water, 100 l each were collected. The carriers of Sr and Cs were added immediately after the sampling, and the samples were vigorously stirred and filtered, then passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in fresh water obtained from November, 1979, to May, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, pH, and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.27 pCi/l of Sr-90 and 0.05 pCi/l of Cs-137 found in Kasumigaura in May, 1980.

20852 (NIRS-RSD—53, pp 32-33) **Strontium-90 and cesium-137 in sea fish; from Dec. 1979 to Jun. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Fish were rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from December 1979 to June 1980 were shown in a table.

20853 (NIRS-RSD—53, pp 34-35) **Strontium-90 and cesium-137 in shellfish; from Feb. 1980 to Jun. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Approximately 4 kg of shellfish including the shells was collected or purchased. After removing the shells, each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from February 1980 to June 1980 were shown in a table.

20854 (NIRS-RSD—53, pp 36-37) **Strontium-90 and cesium-137 in seaweeds; from Nov. 1979 to Jun. 1980. Radioactivity survey related with environmental and dietary materials.** Jun 1980. NTIS (US Sales Only), PC A03/MF A01.

In Radioactivity survey data in Japan.

Edible seaweeds were collected and rinsed with water to remove sand and other adhering matters on the surface. These were removed of excess water, weighed, dried and ashed. The results obtained from November 1979 to June 1980 were shown in a table.

20855 (NIRS-RSD—54, pp 24-25) **Strontium-90 and cesium-137 in sea sediments (from June 1980 to Sept. 1980). Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of sea sediment were collected in the same areas as those of sea water sampling, where the water depth exceeds 1 m at low tide, significant sediment movement is not observed, and mud, silt and fine sand are preferable. Conventional sediment sampling devices were used. Approximately 4 kg wet weight of the samples were spread on large porcelain dishes, and dried in electric furnaces. After the removal of foreign matters, the sediment samples were ground, sieved, and heated in the presence of Sr and Cs carriers together with sodium hydroxide. Then, the samples were heated with hydrochloric acid. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in sea sediment obtained from June to September, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, depth (m), and the amounts of Sr-90 and Cs-137 (pCi/kg) are shown. The maximum values are 20 pCi/kg of Sr-90 and 220 pCi/kg of Cs-137 found in Mutsu Bay in August, 1980.

20856 (NIRS-RSD—54, pp 15-16) **Strontium-90 and cesium-137 in service water (from June 1980 to Dec. 1980). Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of service water, 100 l each, were collected at the intakes of water treatment plants and at taps after water was left flowing out for 5 min. The carriers of Sr and Cs were added immediately after the sampling, and the samples were vigorously stirred and filtered. They were passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in service water obtained from June to December, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, pH, and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.39 pCi/l of Sr-90 in tap water found in Wakkanai in July, 1980, and 0.03 pCi/l of Cs-137 in source water found in Sapporo in June, 1980.

20857 (NIRS-RSD—54, pp 17-18) **Strontium-90 and cesium-137 in fresh water (from May 1980 to Dec. 1980). Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of fresh water, 100 l each, were collected. The carriers of Sr and Cs were added immediately after the sampling, and the samples were vigorously stirred and filtered, then passed through cation exchange columns. Sr and Cs were eluted with hydrochloric acid from the cation exchange columns. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters for 60 min. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in fresh water obtained from May to December, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, pH, and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.27 pCi/l of Sr-90 and 0.05 pCi/l of Cs-137 found in Kasumigaura in May, 1980.

20858 (NIRS-RSD—54, pp 22-23) **Strontium-90 and cesium-137 in seawater (from June 1980 to Sept. 1980). Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

The samples of seawater were collected at the fixed stations, where the effect of terrestrial fresh water from rivers is negligibly small, when there was no rainfall for the last several days. The contamination of the samples was carefully prevented. Immediately after the collection, the samples were acidified to the pH lower than 3 with concentrated hydrochloric acid, and stored. 200 ml of seawater was also collected at the same stations for chlorinity test. Sr-90 and Cs-137 were separated from the sample solutions by the methods described, and their activities were counted with low background beta counters. The net rate of sample counting was corrected for the counter efficiency, recovery, self-absorption and decay. As the environmental data, the results of Sr-90 and Cs-137 in seawater obtained from June to September, 1980, and the locations of sampling are given. In a table, the months and the locations of sampling, Cl (%), sample volume analyzed (l), and the amounts of Sr-90 and Cs-137 (pCi/l) are shown. The maximum values are 0.19 pCi/l of Sr-90 found in Osaka Bay in July, 1980, and 0.19 pCi/l of Cs-137 found in Mutsu Bay in August, 1980.

20859 (NIRS-RSD—54, pp 41-43) **Strontium-90 and cesium-137 in sea fish; from Jan. 1980 to Dec. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Fish were rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from January 1980 to December 1980 were shown in a table.

20860 (NIRS-RSD—54, pp 44-45) **Strontium-90 and cesium-137 in freshwater fish; from Dec. 1979 to Dec. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Fish were rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from December 1979 to December 1980 were shown in a table.

20861 (NIRS-RSD—54, pp 46-47) **Strontium-90 and cesium-137 in shellfish; from Jul. 1980 to Nov. 1980. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Approximately 4 kg of shellfish including the shells was collected or purchased. After removing the shells, each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace. The results obtained from July 1980 to November 1980 were shown in a table.

20862 (NIRS-RSD—54, pp 48-49) **Strontium-90 and cesium-137 in seaweeds; from Apr. 1980 to Jan. 1981. Radioactivity survey related with environmental and dietary materials.** Sep 1980. NTIS (US Sales Only), PC A04/MF A01.

In Radioactivity survey data in Japan.

Edible seaweeds were collected and rinsed with water to remove sand and other adhering matters on the surface. These were removed of excess water, weighed, dried and ashed. The results obtained from April 1980 to January 1981 were shown in a table.

20863 **(UCRL—89778) On-line liquid-effluent monitoring of sewage at Lawrence Livermore National Laboratory.** Dreicer, M.; Cate, J.L.; Rueppel, D.W.; Huntzinger, C.J.; Gonzalez, M.A. (Lawrence Livermore National Lab., CA (USA)). 31 Aug 1983. Contract W-7405-ENG-48. 6p. (CONF-840512—2). NTIS, PC A02/MF A01. Order Number DE83017837.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

LLNL's sanitary sewer system is a possible route for the escape of toxic materials. Liquid effluents are released to Livermore's sanitary sewer system and the effluent is treated at the Livermore Water Reclamation Plant (LWRP). The plant is a secondary-treatment operation that returns most of the water to the San Francisco Bay via a transport pipeline. The remaining portion is used for irrigating vegetation along the roadways and a local golf course. An automatic on-line, sewage-effluent-monitoring system has been developed that diverts a representative fraction of the total waste stream leaving the site. This portion is monitored for pH, radiation, and heavy metals as it passes through a detection assembly. The assembly consists of an industrial pH probe, two NaI radiation detectors, and an x-ray fluorescence metal detector. A microprocessor collects, reduces, and analyzes the data to determine if the levels are acceptable by established environmental limits.

5204 Thermal Effluents Monitoring And Transport

20864 **(DP-MS—83-102) Replacement by Caenis diminuta walker (ephemeroptera:caenidae) in the mayfly community structure of a thermally-stressed, southeastern stream.** Poff, N.L.; Matthews, R.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Indiana Univ., Bloomington (USA). School of Public and Environmental Affairs). 1984. Contract AC09-76SR00001. 29p. (CONF-840565—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84005180.

From 32. annual North American Bethological Society meeting; Raleigh, NC, USA (23 May 1984).

Mayfly community structure on sycamore and sweetgum leaf packs in a thermally-stressed, post-thermal and an unstressed stream were compared. Leaves were colonized over an 11 wk (77 d) period from December 1982 to March 1983. Degree-days (> 0°C) accumulated were 1014, 638 and 627 for the thermally-stressed, post-thermal and unstressed streams, respectively. Significant differences in mayfly community structure were found between the thermally-stressed vs. the post-thermal and unstressed streams with respect to both Stenonema spp. and Caenis diminuta Walker. No significant differences in community structure were found between the two leaf species. Stenonema spp. dominated the mayfly fauna over the sampling period for both the unstressed (68%) and post-thermal (98%) streams; however, C. diminuta replaced Stenonema spp. as the dominant mayfly (88%) within leaf packs from the stream receiving thermal effluent. Additional data suggest C. diminuta is tolerant of rapidly fluctuating thermal regimes (Δ T of up to 11°C in 1 h) and high temperatures (up to 40°C). 30 references, 3 figures, 3 tables.

20865 **(TVA/ONR/WRF—83/14(b)) Responses of selected aquatic biota in Watts Bar Reservoir to thermal discharges from Kingston Steam-Electric Plant in 1978 and 1979. Appendices.** Craven, T.M.; Dycus, D.L.; Tomljanovich, D.A. (Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources). Jul 1983. 132p. NTIS MF A01. Order Number DE84900345.

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Data are provided from the 1978-1979 studies on the Watts Bar Reservoir. Sampling locations include: Kingston Steam-Electric Plant, Clinch River and Emory River. Data concerning water quality (temperature, D.O., pH, and conductivity) and sediment size are provided in Appendices A-D. Phytoplankton data including summaries, numbers of each genera and chlorophyll/phaephyton concentration are provided in Appendices E-H. Appendices I,J,K and L contain periphyton data while Appendices M,N, and O list zooplankton data. Numbers and distribution of benthos are provided in Appendices P and Q. (MDF)

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 20868, 20869, 20870

20866 **(SREL—15) Wood Storks of the Birdsville colony and swamps of the Savannah River Plant.** Meyers, J.M. (Savannah River Ecology Lab., Aiken, SC (USA)). 16 Feb 1984. Contract AC09-76SR00819. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008574.

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Wood Stork feeding sites were studied during the second half of the nesting season for the Birdsville colony (Jenkins Co., Georgia). Foraging locations of the storks were determined. The microhabitat, water quality, and fish density were characterized at stork foraging sites and food resources determined. 14 references, 9 figures, 11 tables.

5206 Regulations

REFER ALSO TO CITATION(S) 20819, 20867

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5302 Assessment Of Energy Technologies

20867 **(NP—4770177) Environmental impact analysis - instrument for planning without political relevance.** Bechmann, A. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Landschaftsentwicklung). 1982. 329p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84770177.

A summary of reports, working groups of the information exchange and the final plenary session of the 1981 Fachbereichstag des FB 14 (Landscape Development Department Day) of the Technical University of Berlin is given. The three topics run as follows: the present state of the environmental discussion on the introduction of environmental impact analysis, case studies from regional planning, useful to demonstrate political controversies (and scientific as well as planning approaches) relating to environmental impact analyses, the presentation of fundamental of scienitific planning methods with regard to the contents of environmental impact analyses.

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 19646, 19682, 19897, 19898

20868 **(FERC/EIS—0005) Kerckhoff Project No. 96, California. Final environmental impact statement.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Feb 1979. 317p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE84009442.

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The Pacific Gas and Electric Company (Applicant) filed on August 30, 1970, and amended on June 20, 1977, an application for a license to modify, operate, and maintain the Kerckhoff Project, FERC No. 96, located on the San Joaquin River in Fresno and Madera Counties, California. The modified Kerckhoff Project (Kerckhoff No. 2) would utilize the existing reservoir, powerhouse, and transmission facilities in addition to proposed new facilities. Upon completion of the proposed addition, the water from Kerckhoff Lake would be routed through Kerckhoff No. 2 Powerhouse instead of the existing Kerckhoff Powerhouse. The existing powerhouse would be utilized when flows in the San Joaquin River exceed the capacity of the Kerckhoff No. 2 Powerhouse or when there is a power outage of the Kerckhoff No. 2 Powerhouse. Environmental impacts resulting from construction, operation, and maintenance of the Kerckhoff Project would include: the combined permanent and temporary loss of approximately 80 acres of wildlife habitat; and the disturbance of wildlife by construction activities; the loss of aquatic habitat due to reduced flows between the existing and proposed powerhouses, and the dredging of 1000 feet of streambed for the tailrace; adverse impacts on water quality from spoil areas leaching and turbidity caused by erosion during construction; adverse impacts on the aesthetics of the area caused by the construction of project facilities, access roads, and the spoils areas; improved access into the Temperance Flat Area; the disturbance of archeological sites by construction activities; increased public access to project lands; safety hazards in the tailrace area resulting from the fluctuating water level; and potential loss of spawning areas and reproducing stocks of striped bass and American shad in Millerton Lake. 32 references, 32 figures, 13 tables. (MDF)

20869 **(FERC/EIS—0011) North Fork Stanislaus River Project No. 2409, California. Final environmental impact statement.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Jun 1980. 358p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84009439.

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Calaveras County Water District (Applicant) is proposing to construct a 205.2 MW hydroelectric project on the North Fork Stanislaus River, Stanislaus River, Highland Creek, Beaver Creek, Silver Creek, and Duck Creek in the vicinity of Arnold, California. This action would require construction of: a dam immediately below Spicer Meadow Dam on Highland Creek; a powerhouse on the outlet works of the proposed Spicer Meadow Dam; a diversion dam on the North Fork Stanislaus River, immediately downstream of the confluence of Silver and Duck Creeks; a diversion tunnel leading to Spicer Meadow Reservoir; a diversion dam on the North Fork Stanislaus River at McKays Point; a diversion dam on Beaver Creek, downstream of Calaveras Big Trees State Park, diverting water through a tunnel to McKays Point Reservoir; a tunnel from McKays Point Reservoir to the powerhouse at Clark Flat; a powerhouse at Clark Flat on the Stanislaus River, approximately 1 mile below the confluence of the North and Middle Fork Stanislaus Rivers; an afterbay dam on the Stanislaus River; access roads; two transmission lines; recreational facilities at Spicer Meadow Reservoir; and appurtenant facilities. 40 references, 10 figures, 28 tables.

20870 **(FERC/EIS—0015) Sultan River Project No. 2157, Washington. Final environmental impact statement.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Mar 1981. 284p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84009436.

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The Public Utility District No. 1 of Snohomish County, and the City of Everett, Washington (Applicants), are proposing to construct a 112-MW powerhouse at the existing Sultan River project, which consists of a storage reservoir (Spada Lake) on the Sultan River. This action would require raising the existing Culmback Dam by 62 feet, thus enlarging Spada Lake by 1100 acres; construction of 7.6 miles of tunnel and conduit from the lake to the powerhouse, 3.4 miles of water supply pipeline, 1.5 miles of new or upgraded roads, and 3.7 miles of 115-kV transmission line. Construction would commence in 1981, and be completed in 1984. 51 references, 32 figures, 29 tables.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

REFER ALSO TO CITATION(S) 20815

20871 **(ABCC—17-60) Some demographic characteristics of Hiroshima City, 1958, related to exposure to the Atomic Bomb (Based on the 1958 Interim Urban Population Survey of Hiroshima Prefecture). Preliminary report.** Ishikuni, Naoji; Kato, Hiroo; Matsumoto, Y. Scott. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 17 Aug 1960. Contract AC01-76EV03081. 23p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008160.

Based upon the data obtained by the Interim Urban Population Survey conducted on October 1, 1958, in the cities of Hiroshima Prefecture, a comparison has been made between the demographic characteristics of the Hiroshima City atomic bomb survivors and those of the nonexposed. Analysis of the data revealed: (1) the estimated number of persons exposed to the Hiroshima atomic bomb and still residing in Hiroshima City on October 1, 1958 was 92,180; (2) the annual mean rates of in-migration and out-migration of the exposed population during the eight year period from 1950 to 1958 were both approximately 2%, while those for the nonexposed were 8% and 4% respectively; (3) the rate of unmarried exposed females tended to be higher than the rate of unmarried women not exposed, while no difference was noted for single males by exposure status; (4) proportionately greater numbers of exposed persons were engaged in primary and secondary industries (agriculture and manufacturing), while a proportionately greater number of nonexposed were engaged in tertiary industry (commerce, government service, and service work); (5) of those in the labor force the ratio of unemployed in the exposed population seemed slightly higher, but due to the small number surveyed, statistical confirmation was not possible. Of those not in the labor force, no difference was noted according to exposure status; (6) in the sickness prevalence rate no difference could be observed between the exposed and nonexposed.

5502 Biochemistry

REFER ALSO TO CITATION(S) 20560, 20561, 20889, 20892, 20928, 20930, 20931, 20943

20872 **(ABCC—14-61) Properties of acatalasic cells growing in vitro.** Krooth, R.S.; Howell, R.R.; Hamilton, H.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Jul 1961. Contract AC01-76EV03081. 25p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008436.

Acatalasia, a disease due to homozygosity for a Mendelian gene, is characterized by the absence of the enzyme catalase from the tissues of the human body. Red cells from heterozygotes have enzyme activities about one-half normal. In this report, the development of cell lines from skin biopsies of an affected homozygote, a heterozygote and eight control patients is described. The cell type is the euploid fibroblast. It was found that acatalasic cells lacked the enzyme, even after growing for many months in a medium rich in catalase. The control lines all had mean catalase activity double

or more that of the heterozygous line. Selection experiments, measuring growth of cells exposed for 20 minutes to varying concentrations of hydrogen peroxide, did not provide a system for preferentially eliminating acatalastic cells. Certain other experiments were performed bearing on the enzymatic defect in this disease. 23 references, 7 figures, 6 tables.

20873 **(ABCC—23-62) Catalase protein of acatalasemic red blood cells: an electrophoretic and immunologic study.** Takahara, Shigeo; Ogata, Masana; Kobara, Thomas Y.; Nishimura, Edwin T.; Brown, W.J. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Feb 1963. Contract AC01-76EV03081. 18p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008108.

Studies on ethanol-chloroform extracts of erythrocytes of subjects with hereditary acatalasemia and normal red blood cells were performed by the use of paper, Tiselius, and starch block electrophoresis, microprecipitin ring tests, and quantitative precipitin studies. In the paper electrophoretic and Tiselius electrophoretic patterns of catalase protein extracted from normal blood, a main moving peak having a slow mobility and containing the globin fraction of hemoglobin, and a small, faster moving peak containing catalase, may be observed. In starch block electrophoresis similar results with better resolution were obtained. The protein concentration of the faster peak obtained from the electrophoretic migration on paper strips of a Herbert and Pinsent stage 2 extract of acatalasemic blood is lower than that obtained from normal blood. Reaction between crude catalase solution from acatalasemic blood and catalase antibody is negligible as determined by the microprecipitin ring test. The concentration of catalase protein of stage 2 acatalasemic blood extract proves to be nearly zero, as calculated from the standard quantitative precipitin curve. 25 references, 9 figures.

20874 **(ABCC-TR—21-66) Lactic dehydrogenase activity and the metabolism of human leukocytes in seven-day cultures.** Bloom, A.D.; Wajima, Takeshi; Tsuchioka, Masanori. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 21 Jul 1966. Contract AC01-76EV03081. 10p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008142.

The normally seen increase in the cathodal band activity of lactic dehydrogenase isozymes at 72 hours of leukocyte culture is accompanied by intense mitotic activity and transformation of lymphocytes into blast-like forms. The increased levels of lactic acid by 168 hours of culture, together with the variation in M subunit synthesis at that time, suggest that isozyme synthesis in this system is related less to the aerobic-anaerobic metabolic pathways of the cells than to mitosis and the state of differentiation in vitro. 9 references.

20875 **(NP—4770187) First description and characterization of cytochromes in methanogenic bacteria.** Kuehn, W. (Goettingen Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 1 Jul 1982. 238p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84770187.

A membrane-bound cytochrome b-559 was discovered in Methanosarcina barkeri, strain Eusaro. This cytochrome was formed irrespective of whether the cells were cultivated on H_2 + CO_2 or on methanol, mono-, di-, or trimethylamine or acetate. For growth on selected substrated (methanol, mono-, di- and trimethylamine) it has been shown that the membranes contain, in addition, small amounts of available c-type cytochrome. The content of cytochrome-b varies for different substrates between 0.27 and 0.50 μmol/g protein. Cytochrome-c content ranged from 0.016 to 0.075 μmol/g protein. Soluble cytochrome could not be detected. The fine structure of the absorption bands of membrane-bound cytochrome was characterized with the aid of derivative and law temperature spectroscopy. The presence of a number of cytochrome-b species was indicated thereby.

20876 **Energetics of photosynthesis in Zea mays I. Studies of the flash-induced electrochromic shift and fluorescence induction in bundle sheath cells.** Leegood, R.C. (A.R.C. Research Group on Photosynthesis, The University, Sheffield, United Kingdom); Crowther, D.; Walker, D.A.; Hind, G. *Biochimica et Biophysica Acta;* 722: 116-126(1983).

Bundle sheath strands free of mesophyll contamination were isolated from 3-4-week-old leaves of maize (Zea mays L.) Patterns of electron flow in the preparations were studied in the presence of physiological substrates. Relative electron flow rates were estimated from the flash-induced electrochromic band shift changes (P-518) and cytochrome f turnover. Induction of chlorophyll fluorescence was also measured. Little Photosystem II activity was found to be present, the principal pathway of electron flow being Photosystem I-driven cyclic electron transfer. The latter was activated through reductive poising by NADPH, generated via malate decarboxylation or (less efficiently) from dihydroxyacetone phosphate. The actions of these electron donors and of oxygen, nitrite and methyl viologen as electron acceptors in redox poising the Photosystem I-driven cycle were investigated and are discussed in relation to the regulation of photosynthesis in the bundle sheath.

20877 **In vitro DNA synthesis as a tool to analyze and alter genes.** Messing, J. (Univ. of Minnesota, St. Paul). pp 9-15 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

This overview describes some of the biochemical procedures which are used to analyze the primary structure of genetic information. This is one of the first steps in engineering genetic material so that it can be used for the production of materials in the medical, agricultural, and chemical industries. The biochemical procedure which is used for both steps involves the synthesis of DNA in vitro. One of the two DNA strands, in some cases both strands, is then copied into a newly synthesized DNA strand. The part of the template which is copied into the complementary information is defined by the 3′ end of a DNA strand complementary to the template. This piece of complementary DNA which can be very short and is named a primer is required since DNA polymerase in vivo as well as in vitro cannot initiate DNA synthesis on a DNA template with deoxynucleotidetriphosphates.

20878 **Computer applications in recombinant DNA research.** Modelevsky, J.L. (Lilly Research Labs., Indianapolis, IN). pp 17-34 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

Computers can save labor, increase productivity, and permit instantaneous exchange and analysis of information. Clever applications of the computer can assist in data acquisition and analysis, in the modeling of test systems, and can provide rapid solutions to complex theoretical problems. Recombinant DNA research relies heavily upon sequence analysis at the nucleotide and amino acid levels. Such analyses, for the most part, are based upon complex algorithms which are unmanageable for the researcher, but are routine for the computer. A set of 35 programs (MAD sets) has been developed which can manipulate, analyze, display, and store nucleic acid and amino acid sequences. Sequence manipulating programs are extremely valuable in nearly every thought and design process that the recombinant DNA scientist goes through. The computer can store any number of DNA, RNA, or amino acid sequences. These sequences may be accessed instantaneously, regardless of the size of the data base. Using the computer, we can manipulate stored sequences and simulate nearly every manipulation we might carry out in the test tube.

20879 **Human immune interferon (IFN-γ).** Gray, P.W.; Goeddel, D.V. (Genentech, Inc., San Francisco, CA). pp 35-61 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

Human IFN-γ is encoded by a single gene which, in contrast to the IFN-α and IFN-β genes, contains three introns. This gene has been isolated from a recombinant human-λ gene library, and the entire gene and 5′ and 3′ flanking regions have been sequenced. Southern hybridizations failed to show any polymorphism of the

gene or its flanking regions. The first intron contains a repetitive element which is unrelated to the Alu family repeat.

20880 **Research on gene therapy.** Cline, M.J. (Univ. of California, Los Angeles). pp 77-92 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

I would like to consider a particular system for introducing new genetic information into living animals. One objective of our work was to introduce genes into the hematopoietic cells of mice so that models for treating human genetic diseases could be developed. The gene transfer system we decided upon involved a drug resistance gene with methotrexate (MTX). We sought a source of genes for resistance to this drug. In seeking a source of drug resistance genes, we examined a variety of mouse and hamster cell lines which could grow at very high levels of methotrexate. We selected a cell line for detailed study which continued to grow at 4×10^{-4} M methotrexate. In introducing drug resistance genes into hematopoietic cells, it is likely that genes are introduced at a low copy number. Therefore, if it is to be effective, the introduced gene had better code for an exceedingly effective drug resistant enzyme. The evidence that this MTX-resistant transformed cell line (3T6R1 cells) contained a mutant dihydrofolate reductase can be briefly summarized. The isolated enzyme from wild-type MTX-sensitive cells is readily inhibited at increasing concentrations of methotrexate, and at about 10^{-8} M MTX the wild-type mouse enzyme is about 50 percent inhibited. DHFR enzyme from the resistant 3T6R1 cell line containing a mutant enzyme is highly resistant to the inhibitory effects of methotresate and functions at 10^{-5} M drug concentration. The mutant DHFR has altered heat stability and electro- phoretic mobility.

20881 **Novel applications of monoclonal antibodies.** Martinis, J.; David, G.S.; Bartholomew, R.M.; Wang, R. (Hybritech, Inc., San Diego, CA). pp 129-154 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

The ability to engineer antibodies, using the techniques of somatic cell genetics and cell fusion, has opened a new era in immunochemistry. No longer are immunologists limited by the vagaries of polyclonal antibody production. Using hybridoma technology, consistent preparations of precisely defined monoclonal antibodies are now available. Immunochemists are free to pick and choose those precisely defined characteristics of a homogeneous species of antibody that are best suited for a given application. To date, monoclonal antibodies have been used primarily as research chemicals. However, the implications of this new technology for diagnostic, therapeutic, and separation systems are rapidly becoming apparent.

20882 **Biochemical studies on the sucrose synthase gene in Zea mays L. and on controlling element Ds inserted at this locus.** Courage-Tebbe, U.; Doering, H.P.; Geiser, M.; Starlinger, P.; Tillmann, E.; Weck, E.; Werr, W. (Universitat Koeln, Germany). pp 159-171 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

We have looked for means to study corn controlling elements at the molecular level. The starting point for the biochemical study of transposable elements in corn must be the isolation and identification of a DNA sequence. We chose the gene Sh which encodes endosperm sucrose synthase. We showed that developing endosperm contains the mRNA for sucrose synthase using cell-free translation in reticulocyte lystates and immunoprecipitation of the product. In the next step, we prepared cDNA from the mixture of endosperm mRNAs and cloned it in pBR322, using GC tailing. From a collection of approximately 250 clones obtained by transformation of E. coli, we isolated one clone that contained an insert transcribed from the sucrose synthase gene. The cDNA clone was nick-translated and used as a probe in Southern hybridization experiments with genomic DNA obtained from the wild type and several mutants caused by the insertion of Ds at the sucrose synthase gene.

20883 **Use of Ti-plasmids for the genetic engineering of plants.** Schroeder, J. (Max-Planck-Institut fuer Zuechtungsforschung, Koeln, Germany); De Greve, H.; Hernalsteens, J.P.; Leemans, J.; Van Montagu, M.; Otten, L.; Schroeder, G.; Willmitzer, L.; Schell, J. pp 173-193 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

These results clearly show that Agrobacterium tumefaciens performs a true genetic manipulation of plants by transferring genes which are actively expressed in plant cells. The exact functions of most T-DNA gene products are not known. However, the action of the genes leading to hormone-independent growth may be formally compared with the effects of a balanced addition of cytokinins plus auxins to the growth medium of normal cells, since that leads to undifferentiated growth with non-transformed plant cells. If this comparison is meaningful, it should be possible to identify the DNA sequences responsible for the hormone-like effects by analyzing tumors induced with mutant Ti-plasmids with a T-region modified by deletion or insertion of DNA in defined locations. This general approach to identify functions of the T-DNA had led to a rough localization of the regions responsible for octopine and nopaline synthesis in plant cells.

20884 **Suicide enzyme inactivators.** Abeles, R.H. (Brandeis Univ., Waltham, MA). pp 287-305 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

There appear to be two stragegies for the inactivation of serine proteases: one could employ a compound which, after acylenzyme formation, unmasks a reactive species that could react with the imidazole. This would lead to enzyme inactivation since the incoming nucleophile would no longer be activated towards reaction with the acyl-enzyme. Alternatively, a substrate could be employed that generated an acyl-enzyme, which hydrolyzes at a very slow rate. That may have some advantages. For pharmacological purposes, it might be more desirable to inactivate an enzyme for a period of time rather than to inactivate it forever. Examples of both kinds of strategies are given.

20885 **Utilization of inorganic pyrophosphate, tripolyphosphate, and tetrapolyphosphate as energy sources for the growth of anaerobic bacteria.** Peck, H.D. Jr. (Univ. of Georgia, Athens); Liu, C.L.; Varma, A.K.; Ljungdahl L.G.; Szulczynski, M.; Bryant, F.; Carreira, L. pp 317-348 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

Inorganic pyrophosphate (PP/sub i/) has been shown to be utilized as a source of energy for the growth of a number of pure cultures of anaerobic bacteria and isolates from marine and fresh water environments. The microorganisms generally require a source of fixed carbon such as yeast extract for growth but with some of the sulfate reducing bacteria, acetate and sulfate were also required. Growth is proportional to the concentration of PP/sub i/ over a limited range and growth is always accompanied by the hydrolysis of PP/sub i/ to orthophosphate. PP/sub i/ was also demonstrated to modify fermentations without effecting growth. Thus, methane formation by Methanosarcina barkeri from acetate, methanol or H_2 plus CO_2 is stimulated 2 to 3 fold in the presence of PP/sub i/ and, with the latter two substrates, an accumulation of acetate is observed without a significant increase in growth. Enrichment cultures have been obtained using tripolyphosphate and tetra-

polyphosphate and it is evident that these polyphosphates can also be utilized as a source of energy for the growth of anaerobic microorganisms. An enzyme has been purified from Thermoanaerobacter ethanolicus which exhibits both PP/sub i/:acetate kinase and ATP:acetate kinase activities and it is suggested that this kinase may be responsible for the widespread ability among anaerobic bacteria to utilize PP/sub i/ as a source of energy.

20886 **Protein modifications induced in mouse epidermis by potent and weak tumor-promoting hyperplasiogenic agents.** Nelson, K.G.; Stephenson, K.B.; Slaga, T.J. (Oak Ridge National Lab., TN). *Cancer Research;* **42**: 4164-4175(Oct 1982). Contract W-7405-ENG-26.

Two-dimensional gel electrophoresis was used to compare the changes in mouse epidermal proteins induced by the potent tumor promoter 12-O-tetradecanoylphorbol-13-acetate (TPA), by the moderate promoter mechanical abrasion, and by the weakly promoting hyperplasiogenic agents mezerein and ethylphenylpropiolate. Evidence is presented which indicates that TPA caused many changes in the epidermal protein profiles especially related to the keratins which are the major differentiation product of the epidermis. The criteria used for the identification of the keratins were extractability, isoelectric points, molecular weights, filament formation in vitro, immunological cross-reactivity, amino acid composition, and peptide mapping. Several other protein changes were evident in the more soluble epidermal proteins which were also prominent in the newborn epidermis. Mezerein and abrasion produced protein changes similar to those induced by TPA. Ethylphenylpropiolate-induced protein modifications not only occurred at later times compared with either mezerein or TPA but also were less in magnitude. However, although many of the protein modifications induced by TPA appear to be associated with the hyperplasiogenic properties of TPA, the major difference between a potent promoter like TPA and a weak promoter like ethylphenylpropiolate appeared to be related to the magnitude of the response and the time of appearance of the protein changes.

20887 **Down-modulation of receptors for phorbol ester tumor promoter in primary epidermal cells.** Solanki, V.; Slaga, T.J. (Oak Ridge National Lab., TN). *Carcinogenesis (New York);* **3**: No. 9, 993-998(1982). Contract W-7405-ENG-26.

The specific [20-^{3}H]phorbol 12,13-dibutyrate ([^{3}H]PDBu) binding to intact epidermal cells displayed the phenomenon of down-modulation, i.e., the specific binding of [^{3}H]PDBu to its receptors on primary epidermal cells reached a maximum within 1 h and steadily declined thereafter. The apparent down-modulation of radiolabel resulted from a partial loss in the total number of receptors; the affinity of receptors for the ligand was essentially unchanged. A number of agents such as chloroquine, methylamine, or arginine which are known to prevent clustering, down-modulation, and/or internalization of several hormone receptors did not affect the down-modulation of phorbol ester receptors. Furthermore, cycloheximide had no effect either on down-modulation or on the binding capacity of cells. The surface binding capacity of down-modulated cells following a 90-min incubation with unlabeled ligand was almost returned to normal within 1 h. The effect of the antidepressant drug chlorpromazine, which is known to interact with calmodulin, on [^{3}H]PDBu binding was also investigated. Our data indicate that the effect of chlorpromazine on [^{3}H]PDBu binding is probably unrelated to its calmodulin-binding activity.

5503 Cytology

REFER ALSO TO CITATION(S) 20886, 20887, 21133

20888 **Extracts of chronic lymphocytic leukemia lymphocytes have a high level of DNA repair activity for O^6-methylguanine.** Waldstein, E.A.; Cao, E.H.; Miller, M.E.; Cronkite, E.P.; Setlow, R.B. (Brookhaven National Lab., Upton, NY). *Proceedings of the National Academy of Sciences of the United States of America;* **79**: 4786-4790(Aug 1982).

Extracts of peripheral lymphocytes from six individuals with chronic lymphocytic leukemia (CLL) were assayed for the ability to remove O^6-methylguanine (O^{6}MeGua) from exogenous DNA. The O^{6}MeGua-removing activity in CLL lymphocytes, predominantly B cells, was approximately 7-fold higher than in B lymphocytes of normal individuals and about 2-fold higher than in the unstimulated T type cells of normal persons. The activity measured in extracts of lymphocytes from three blood relatives was in the upper range of the normal distribution. Over 80% of the removal of O^{6}MeGua was accomplished by the transfer of the methyl group to cysteine moieties of acceptor proteins in a stoichiometric reaction. If one assumes one acceptor group per acceptor protein, the calculated number of acceptor molecules per CLL lymphocyte falls between 91,000 and 220,000. Thus CLL lymphocytes do not show lower O^{6}MeGua-removing activity, in contrast to many tumor cell strains or transformed cell lines, which are reported to have a deficient methyl excision repair phenotype (Mer$^-$). Instead, the CLL lymphocytes act as if they have a super-Mer$^+$ phenotype.

20889 **Effects of retinoic acid on cell proliferation and cell differentiation in a rat tracheal epithelial cell line.** Klann, R.C.; Marchok, A.C. (Oak Ridge National Lab., TN). *Cell and Tissue Kinetics;* **15**: 473-482(1982). Contract W-7405-ENG-26.

The effects of 3.3 x 10^{-7} M to 3.3 x 10^{-5} M all-trans-retinoic acid (vitamin-A acid) on the total cell population dynamics of 165 S, a keratinizing epithelial cell line from carcinogen-exposed rat trachea, were studied. During the first 6 days of culture, cells accumulated on the dish in the presence of the vitamin to twice the density of controls. [^{3}H]thymidine incorporation into DNA and percentage of [2#H]thymidine-labelled cells in autoradiographs were stimulated in a dose-dependent fashion to a maximum of 25- and 34-fold, respectively. Exfoliation of cells from the cultures was also enhanced 2-3-fold, resulting in nearly twice the total number of cells (attached plus exfoliated) in the presence of the vitamin. During 19 days of culture, retinoic acid maintained a higher level of [^{3}H]thymidine incorporation and cell exfoliation in 165 S cells so that by day 19, total cell production was more than three times that seen in controls. At this time, vitamin-treated cultures showed a reduced cell saturation density compared to controls. The higher final cell density in the control cultures was a result of multilayering and papillary formation which did not occur in the presence of retinoic acid. The papillae in control cultures stained specifically with Rhodamine B or with the eosin and orange G components of the Papanicolaou method. A count of the number of eosin and orange G positive cells in the attached and exfoliated cell compartments showed an 8-fold reduction of keratinization in retinoic acid-exposed cultures. Our results show that retinoic acid is a growth stimulant in these cell cultures, causing increased cell proliferation and exfoliation accompanied by inhibition of keratinization.

5504 Genetics

REFER ALSO TO CITATION(S) 20877, 20888

20890 **(ABCC—07-63) Genetic heterogeneity in human acatalasia.** Hamilton, H.B.; Neel, J.V. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Apr 1963. Contract AC01-76EV03081. 20p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008402.

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Catalase values have been determined on the blood of 116 members of an extensive kindred in which 2 sibships are segregating for acatalasia. In contrast to previous studies, in which a clear distinction was observed between the values in heterozygous carriers of the gene and normal individuals, in this kindred carrier values overlapped with normal. To obtain an estimate of the distribution of carrier values two methods were employed. The best estimate appears to be a mean of 3.70 to 3.80 catalase units (as contrasted to a normal value of 5.40) with a range from 2.90 to 4.70 or, less likely, 5.10 units. 25 references, 3 figures, 1 table.

20891 **(ABCC—09-61) Frequency in Japan of carriers of the rare recessive gene causing actalasemia.** Hamilton, H.B.; Neel, J.V.; Kobara, T.Y.; Ozaki, Kyoko. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 17 May 1961. Contract AC01-76EV03081. 29p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008452.

A rapid and simple method to detect the hypocatalasemic heterozygotes for the gene responsible for acatalasemia is described. A total of 13,647 blood specimens from individuals residing in Hiroshima and Nagasaki have been examined in this manner, and the frequency of hypocatalasemia found to be 0.09%. Surveys in other parts of Japan have revealed frequencies of the order of 1.4%. This unevenness in the distribution of a rare recessive gene, taken in conjunction with the known variation from locality to locality in the frequency of inbreeding, has important implications for the interpretation of data on inbreeding effects. Some of these implications are discussed. 17 references, 1 figure, 6 tables.

20892 **Replication kinetics of Chinese hamster chromosomes as revealed by bivariate flow karyotyping.** Cremer, C.; Gray, J.W. (Lawrence Livermore National Lab., Univ. of California, Livermore). *Cytometry (Baltimore);* **3**: No. 4, 282-286(1983). Contract W-7405-ENG-48.

It is shown that the replication kinetics of individual chromosomes can be estimated by bivariate flow cytometric analysis of chromosomes isolated from 5-bromo-2'-deoxyuridine (BrdUrd) treated cells. To study the timing of replication of chromosomes, Chinese hamster M3-1 cells were grown for different times in BrdUrd containing medium. Colcemid was added during the last 90 minutes of each BrdUrd labeling period. Chromosomes were isolated from the Colcemid blocked mitotic cells and stained with Hoechst 33258 (HO) and chromomycin A3 (CA3). Bivariate HO-CA3 flow karyotypes were measured in a dual beam flow cytometer. Labeling cells with BrdUrd for 2, 2 1/2, 3, 3 1/2, and 4 hours before chromosome isolation resulted in progressive quenching of the HO fluorescence of chromosomes Y and 10, 11, M2 while the HO fluorescence of all other chromosomes was either not quenched or was only slightly quenched. The CA3 fluorescence of all chromosomes was slightly enhanced by BrdUrd treatment. A quantitative evaluation of the quenching of HO fluorescence suggested that: a) greater than 50% of HO binding DNA of chromosomes 10, 11, M2 is synthesized in the last quarter of S phase; b) the Y chromosome synthesizes more than 50% of HO binding DNA in the last tenth of S phase making the Y chromosome the latest replicating M3-1 chromosome. All other chromosomes have synthesized greater than 50% of their HO binding DNA before the last third of S phase.

20893 **Mechanism of suppression in Drosophila melanogaster. VIII. Comparison of su(s) alleles for ability to suppress the mutants purple, vermilion, and speck.** Jacobson, K.B.; Grell, E.H.; Yim, J.J.; Gardner, A.L. (Oak Ridge National Lab., TN). *Genetical Research;* **40**: 19-32(1982). Contract W-7405-ENG-26.

The suppressor of sable [su(s)^2] restores the function of vermilion (v), purple (pr) and speck (sp) as well as sable (s) in Drosophila melanogaster. In this report various alleles of su(s) are compared for their relative effectiveness on three target mutations, v, pr and sp. Three criteria for suppression of pr and v were employed: visible phenotype, eye pigment levels (drosopterins and xanthommatin) and enzyme levels (sepiapterin synthase and tryptophan oxygenase). For sp only the visible phenotype was examined. By all three criteria pr was found to be more easily suppressed than v; v and sp were comparable. By use of pr with various alleles of su(s) either homozygously or in heterozygous combination with su(s)$^+$, the extent of suppression of pr can be best demonstrated by observing the levels of sepiapterin synthase; normal levels of drosopterins were found in females when sepiapterin synthase was only 20% of normal. On the other hand, the extent of suppression of v is best demonstrated by the amount of xanthommatin eye pigment.

5505 Metabolism

REFER ALSO TO CITATION(S) 20885, 20929, 21104, 21120, 21121, 21137

20894 **(ABCC—7-66) Relationship of lactic dehydrogenase isozymes to the metabolism of cultured human leukocytes.** Bloom, A.D.; Wajima, Takeshi; Hamilton, H.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Apr 1966. Contract AC01-76EV03081. 13p. (In Japanese and English). NTIS, PC A02/MF A01; I; GPO Dep. Order Number DE84008449.

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The changing patterns of LDH activity in primary cultures of human leukocytes were related to cell metabolism and mitotic activity. The dominance of LDH-1 and LDH-2 seen in noncultured leukocyte suspensions and after the first 24 hours of culture was followed by a shift at 48-72 hours to a pattern in which LDH-3 and LDH-4 significantly increased. The rise in M subunits occurred at the same time as increased numbers of transformed cells and of cells in active mitosis appeared in culture. The level of glucose in the medium fell throughout culture, while the levels of pyruvic and lactic acids maximally increased in the 48 to 72 hour period. Together with the gradual decrease found in oxygen content, these changes suggest that the major energy source early in culture is from aerobic metabolism, while anaerobic glycolysis appears to be the dominant metabolic process late in culture, when the shift to the cathodal bands takes place. The variable response of these cultures to oxygen supplementation is presented. 22 references, 6 figures, 2 tables.

20895 **(ABCC—04-63) Blood ketone response to norepinephrine-induced free fatty acid in diabetes.** Blackard, W.G.; Omori, Yoshiaki. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Apr 1963. Contract AC01-76EV03081. 28p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008390.

During 90-minute norepinephrine infusions, blood free fatty acid and ketone responses of Japanese nondiabetic and diabetic subjects were determined. Nonobese diabetic subjects with and without fasting hyperglycemia demonstrated significantly greater blood ketone elevations than nondiabetics. An inverse correlation between obesity and blood ketone response to nonrepinephrine was observed in diabetics. This correlation could not be attributed to varying degrees of fasting hyperglycemia or free fatty acid elevation. Nonobese diabetics with mild fasting hyperglycemia (90 to 150 mg%) exhibited an unexpected greater increase in blood ketones than nonobese diabetics with moderate fasting hyperglycemia (150 to 250 mg%). Differences in free fatty acid elevations were not responsible for this apparent paradox. The magnitude of the hyperketonemic response, though dependent on free fatty elevation, seemed more sensitive to the degree of obesity and the fasting blood glucose level. Fractional ketone body measurements attributed the blood ketone elevations predominantly to β-hydroxybutyric acid increases. 43 references, 6 figures, 1 table.

20896 **(ABCC-TR—7-66) Relationship of lactic dehydrogenase isozymes to the metabolism of cultured human leukocytes.** Bloom, A.D.; Wajima, Takeshi; Hamilton, H.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Apr 1966. Contract AC01-76EV03081. 13p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008154.

The changing patterns of LDH activity in primary cultures of human leukocytes were related to cell metabolism and mitotic activity. The dominance of LDH-1 and LDH-2 seen in noncultured leukocyte suspensions and after the first 24 hours of culture was followed by a shift at 48 to 72 hours to a pattern in which LDH-3 and LDH-4 significantly increased. The rise in M subunits occurred at the same time as increased numbers of transformed cells and of cells in active mitosis appeared in culture. The level of glucose in the medium fell throughout culture, while the levels of pyruvic and lactic acids maximally increased in the 48 to 72 hour period. Together with the gradual decrease found in oxygen content, these changes suggest that the major energy source early in culture is from aerobic metabolism, while anaerobic glycolysis appears to be

the dominant metabolic process late in culture, when the shift to the cathodal bands takes place. The variable response of these cultures to oxygen supplementation is presented. 22 references, 6 figures, 2 tables.

20897 (NIRS-M—39, pp 131-138) **Structure of fish gill, with special reference to its absorptive and excretory function.** Oguri, Mikio (Nagoya Univ. (Japan). Faculty of Agriculture). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

The gill of fish is not only the respiratory organ, but also the absorptive and excretory one of various substances, such as pesticides, anesthetics and minerals including radionuclides. Branchial absorption of Ca, Cr, Zn, Sr and Hg, and dieldrin (a pesticide) has been demonstrated by the gill-perfusion experiments using eel and rainbow trout. Also, branchial excretion of Cl, Ca and Sr has been ascertained by the same method using eel. Therefore, the gill is an important organ in relation to the accumulation and metabolism of radionuclides in fishes. Compared with the kidney, another excretory organ in fish, the structure of fish gill is rather simple. Histologically, the gill lamella, main functional portion of gill, is enveloped with simple squamous epithelium on each side. Between these two thin layers, pilaster cells and lacuna of branchial capillary are recognized as tissue components. In the gills of marine fishes, well-developed salt-secreting cells are detectable at the basal area of gill lamella. The cytoplasm of these cells are acidophilic and abundant in mitochondria and tubular endoplasmic reticulum. The cells are also called chloride cells and said to be involved in the extra-renal excretion of Na and Cl took in by marine fishes. The important problem is whether the salt-secreting cells in marine fishes are also concerned with the branchial excretion of other minerals such as Ca, Sr, I and so on, or these minerals are excreted across the ordinal epithelial cells of gill lamella. To elucidate this, detailed investigations are awaited with interest.

5506 Medicine

REFER ALSO TO CITATION(S) 20881, 20891, 21103, 21127, 21128, 21129, 21130, 21131, 21132, 21138

20898 **(ABCC—01-59) Carrier state in human acatalasemia: the genetic control of enzyme activity.** Nishimura, Edwin T.; Hamilton, H.B.; Takahara, Shigeo; Kobara, Thomas Y.; Ogura, Yoshio; Doi, Katsusaburo. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Mar 1959. Contract AC01-76EV03081. 8p. (In Japanese and Engligh). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008429.

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In 1949 Takahara and Miyamoto reported four siblings with progressive gangrenous gingivitis in whom catalase activity was not demonstrable in the peripheral blood. In this and subsequent communications, the authors described and elaborated upon the syndrome and coined the term, acatlasemia, since the level of catalase activity in the tissues other than blood could not be ascertained. 11 references.

20899 **(ABCC—03-59) Clean-voided urine culture in surveying populations for urinary tract infection.** Switzer, S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Jul 1959. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008080.

As part of a large-scale epidemiologic survey of A Bomb survivors being conducted by the ABCC in Hiroshima, the feasibility of male and female subjects collecting their own clean-voided specimens was tested. Clean-voided, midstream urine specimens were obtained from 441 ambulant, non-hospital subjects and examined by means of the Gram-stain and quantitative culture technique. Collection was performed by the subjects themselves after appropriate instruction, and this yielded specimens satisfactory for quantitative study. The gram-stain of the urinary sediment proved efficient in presaging true bacilluria. The presence of abundant Gram-negative organisms in a fresh urine sediment may be considered presumptive evidence of a urinary tract infection. Utilizing prepoured, selective media, it was found that counts exceeding 50,000 to 100,000 col./ml. indicate true bacteriuria and will be confirmed by repeated studies. 9 references, 2 figures, 4 tables.

20900 **(ABCC—03-61) Tuberous schlerosis complex and astrocytoma: a case report, Hiroshima.** Rudnick, P.A.; Hoshino, N.; Kitaoka, T.; Miura, M. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 10 Feb 1961. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008105.

This case report concerned a young woman with cutaneous, osseous, and retinal changes of tuberous sclerosis, referred to ABCC for evaluation of blindness and increased intracranial pressure. A right lateral ventricle astrocytoma was successfully removed, but the patient's sight was not restored. The development of cerebral neoplasms in these patients is discussed. A careful search for resectable brain lesions should be made in all patients with tuberous sclerosis who have signs and symptoms of increased intracranial pressure. 14 references, 6 figures.

20901 **(ABCC—05-64) Epidemiology of diabetes mellitus in Japan.** Blackard, W.G.; Omori, Yoshiaki; Freedman, L.R. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Mar 1964. Contract AC01-76EV03081. 24p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008391.

The clinical and epidemiological features of diabetes mellitus in Japan have been compiled and compared with data from other countries. Diabetes is basically the same in Japan as elsewhere: however, consideration of important differences has led to the following conclusions: The rarity of ketoacidosis in Japan is due to the mild carbohydrate defect present in most diabetics. The mild carbohydrate intolerance in diabetics is probably in part due to a high carbohydrate intake. Diabetic retinopathy is more common in women than in men in Japan; there are limited and conflicting data from the West on this point, but retinopathy, nephropathy and neuropathy occur about as frequently in Japan as in the West. Because of marked dietary differences between Japan and Western countries, these findings suggest that dietary fat has no significance in the pathogenesis of these lesions. Peripheral gangrene is distinctly unusual in Japanese diabetics. This suggests that either: the responsible vascular lesions are different from those responsible for nephropathy and retinopathy; or that small vessel lesions are the same but the lack of large vessel atherosclerosis in the population accounts for the decreased incidence of gangrene. Men have diabetes 2 or 3 times as commonly as women in Japan. If sex-limited inheritance is discarded as a possible reason, it is likely that adult-onset diabetes is more common in men than women except in those countries (the West) where women gain relatively large amounts of weight. The rarity of juvenile diabetes in Japan is best explained by the infrequency of responsible genetic factors. As a consequence, it is likely that juvenile diabetes is caused by different or additional genetic factors which are not significant in adult-onset diabetes. Diabetes prevalance varies sufficiently between different localities in the same country to render the concept of national prevalance of doubtful usefulness. 55 references, 3 figures, 3 tables.

20902 **(ABCC—06-63) Clinical features of diabetes mellitus in Japan as observed in a hospital outpatient clinic.** Wada, Sunao; Toda, Shintaro; Omori, Yoshiaki; Yamakido, Michio; Blackard, W.G. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Apr 1963. Contract AC01-76EV03081. 20p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008400.

A university diabetes clinic in Japan was characterized by age at examination, age at onset, sex ratio, microangiopathies, atherosclerotic complications, weight, heredity, and diet. The findings in this clinic, along with those from other diabetes clinics in Japan, were compared with studies on Western diabetics. The similarities between the 2 diabetic populations far outnumbered the dissimilarities. However, diabetes mellitus in Japan is distinguished by infrequent occurrence of juvenile diabetes and ketosis, relative lack of

atherosclerotic complications, and reversal of the sex ratio. 39 references, 7 tables.

20903 **(ABCC—10-62) Study of possible goitrogenic effects of certain Japanese foodstuffs.** Socolow, E.L.; Suzuki, Minoru. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Jun 1962. Contract AC01-76EV03081. 15p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008403.

An experiment was designed to assay the goitrogenic activity of certain Japanese foodstuffs. Groups of rats were fed low iodine basal diet (Remington ration) alone or supplemented with iodine, Chinese cabbage, turnip, buckwheat noodle, soybeam, or seaweed mixture for a period of 5 months. In this experiment goiters developed in the animals of all groups except those fed seaweed. Addition of 2 μg of iodine as sodium iodide per rat per day to the basal Remington ration did not completely prevent the development of goiter. Histologically the goitrous thyroids revealed hyperplastic follicles with scanty colloid, dissimilar to the colloid goiter commonly seen in man. In rats given seaweed or supplemental iodine the thyroids were histologically indistinguishable from normal rat thyroid. It seems likely that the Remington ration increases iodine requirement as shown in the rats given 2 μg of supplemental iodine per day. Furthermore, the iodine content of Chinese cabbage, turnip, buckwheat noodle, and soybean is low and the possibility must be considered that goiter due to relative iodine deficiency developed in animals on these foods. This experiment failed to demonstrate the positive goitrogenic effect of these Brassica vegetables, buckwheat noodles, or soybean. However, the diet containing a large amount of iodine can prevent the development of goiter as shown in the rats given seaweed mixture.

20904 **(ABCC—16-59) Evidence for minimal character of atherosclerosis in hypertensive Japanese farm laborers.** Dahl, L.K.; Wada, Sunao; Eder, H.A.; Gidez, L.I.; Wolins, W.; Jellinger, D.L.; Yamashita, Yoshihiko; Niitani, Ryuzo; Takashina, Seiryo; Sueda, Satoshi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Jul 1960. Contract AC01-76EV03081. 60p. (In Japanese and English). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008440.

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The adult population of a small Japanese farm village near Hiroshima was studied from the standpoint of cardiovascular disease. Although hypertension appeared to be fairly common the clinical picture was significantly different from that commonly observed in the United States since both by clinical and laboratory studies, these Japanese had strikingly little evidence of arteriosclerotic heart disease. This appears to be the usual picture of hypertension among Japanese in whom arteriosclerotic heart disease has not been the serious disease that it is among most western societies. In these people, hypertension kills by cerebrovascular accidents primarily - the leading cause of death in adult Japanese for some years. Various factors which might account for the apparent mildness of atherosclerosis were discussed and comparisons made with the Negro and White American. 82 references, 12 tables.

20905 (ABCC—29-64, pp 7p, Paper 2) **Prolapse or transmigration of esophageal mucosa.** Russell, W.J.; Kogure, Takashi. 23 Apr 1964. (In Japanese and English). NTIS, PC A02/MF A01.

In Case reports 1964: radiology.

A brief review of the literature in English and Japanese pertaining to prolapse or transmigration of esophageal mucosa is given. Synopses of symptoms and clinical findings with illustrations of five cases in whom this abnormality was detected are presented. 10 references.

20906 **(ABCC—30-64) Case reports 1964, medicine: infantile hypertrophic pyloric stenosis in four siblings. Retinopathy and keratopathy due to chloroquine. The first instance of hemoglobin E in a Japanese family.** Burmeister, R.E.; Hamilton, H.B.; Hinds, M.J.A.; Slavin, R.E.; Kamata, Nanao; Shibata, Susumu; Miller, R.J.; Phair, J.P.; Kasahara, Masayuki; Shibata, Susumu. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Jun 1964. Contract AC01-76EV03081. 30p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008423.

This document contains 3 reports. In the first report four siblings are presented who had infantile pyloric stenosis unequivocally demonstrated when pyloromyotomy was performed in the early neonatal period. Their father had symptoms of stenosis as an infant but he was treated medically and it cannot be stated with certainty that he had the disease. Blood groups, determined for the four children and their parents, were not unusual. Chromosome karyotypes, obtained from peripheral blood cultures, were apparently normal. In the second report, a case study of a patient exhibiting side effects due to chloroquine used in the treatment of lupus vulgaris is presented. In the third report, in a survey for hemoglobinopathies in Nagasaki, Japan four members in two generations of a Japanese family were found to have an abnormal hemoglobin, which on detailed chemical analyses was demonstrated to be hemoglobin E. The question of prior introduction of the gene into Japan from Southeast Asia versus independent mutation is briefly discussed. 70 references, 4 figures, 5 tables.

20907 **(ABCC—31-64) Case reports 1964 - pathology. Histoplasmosis of the kidney.** Will, D.W.; Hasegawa, C.M.; Kawauchi, Tadanaga; Murashima, Shoichi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 16 Jul 1964. Contract AC01-76EV03081. 30p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008431.

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A case is presented of isolated renal histoplasmosis in a Nagasaki woman who died of pulmonary tuberculosis following massive x-ray therapy for squamous carcinoma of the mouth. No primary pulmonary lesion was identified. While the patient's history includes a 40-year residence in Malaysia and a brief internment in New Delhi where a few cases of histoplasmosis have been reported, she had been in Japan for 16 years prior to her death. In view of the presently-known absence of viability of Histoplasma in old primary foci, it was concluded that the infection was acquired in Japan and represents the first case of Histoplasma capsulatum infection reported from Japan (37 references, 5 figures). A second case is presented of a 15-year-old Japanese girl with a clinical history and postmortem findings of a subacute necrotizing encephalomyelopathy is reported. The patient's parents were consanguinous and a similar disease was also present in one sibling. This case and those available in the literature indicate that a severe peripheral neuropathy associated frequently with secondary degeneration of the dorsal white columns of the spinal cord constitutes an integral part of the disorder. The presence of peripheral neuropathy reminiscent of that due to deficiency of thiamine and pantothenic acid, frequent familial occurrence of the disorder and consanguinity in some of the parents give support to the speculation of previous investigators that the disease may represent an inborn error of metabolism especially of pyruvate metabolism. 11 references, 15 figures, 1 table.

20908 **(ABCC-TR—2-69) Acute granulocytic leukemia terminating in erythroblastic proliferation, case-report.** Okada, Hiromu; Hoshino, Takashi; Yamamoto, Tsutomu. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Feb 1969. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008138.

A case of acute granulocytic leukemia in a 20-year-old male terminating in excessive erythroblastic proliferation is reported. The diagnostic problems, usual progression of the course of disease and interrelationship of hemic precursors concerning their tumorigenesis and transfiguration observed in this case are discussed in detail. 11 references, 12 figures, 2 tables.

20909 **(ABCC-TR—14-65) Some further observations on the effect of inbreeding on mortality in Kure, Japan.** Schull, W.J.; Neel, J.V. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Nov 1965. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008131.

Analysis of the relationship of mortality in the first 15 years of life to inbreeding in a cohort of 1153 children born in Kure, Japan, fails to disclose a significant effect of inbreeding on mortality. When taken at face value, a small increase in prereproductive mortality is noted with increased inbreeding. These data can be in-

terpreted as evidence contravening the notion that a substantial fraction of the genetic load of the Japanese manifested in death prior to maturity is maintained by classical loci, but other interpretations are possible. 10 references, 3 tables.

20910 **(ABCC-TR—17-68) Roentgenologic abnormalities in Down's syndrome.** Higuchi, Takehiko; Russell, W.J.; Komatsuda, Michio; Neriishi, Shotaro. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 25 Jul 1968. Contract AC01-76EV03081. 14p. (In Japanese and English). NTIS, PC A02/M FA01; GPO Dep. Order Number DE84008124.

Roentgenograms of 28 patients with Down's syndrome were reviewed with emphasis on all previously reported abnormalities and any possible additional ones. Most of the abnormalities occurred with the same frequency as previously reported, but some less frequently reported findings were also seen. One abnormal vertebral measurement found in this series may be an additional stigma of Down's syndrome. All of the 27 cases studied cytogenetically had chromosomal abnormalities consistent with this disease. This study emphasizes the need for roentgenologic norms for the Japanese, and the desirability of combining chromosome studies with roentgenological abnormalities and clinical observations in diagnosing Down's syndrome. 19 references, 2 figures, 5 tables.

20911 **(ABCC-TR—19-65) Case reports, 1965: Incontinentia pigmenti and retrolental mass. Parathyroid cysts.** Miller, R.J.; Anderson, R.E.; Wood, J.W.; Johnson, K.G.; Hinds, M.J.A. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). May 1966. Contract AC01-76EV03081. 22p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008125.

This document contains two reports. In the first report a case of incontinentia pigmenti in a Japanese girl with associated retrolental mass is presented in conjunction with a review of the other known cases of this association in the literature. In the second report, the case of a 42-year-old female with a parathyroid cyst is presented. Review of the literature reveals 38 patients in whom the diagnosis of a parathyroid cyst was supported by the presence of parathyroid tissue within the cyst wall. Of these patients, 70% were women and half of them were less than 40 years old. More than 90% of the cysts are found in the region of the inferior parathyroid glands. The lesion may be associated with symptoms of pain, hoarseness, respiratory obstruction or, in 15% of the cases, with hyperparathyroidism. The cysts commonly increase rapidly in size, but may show periods of remission. It is proposed that these lesions occur more frequently than reports would indicate. It is also believed that the production of clinically significant parathyroid cysts is the result of retention of secretions. 43 references, 7 figures, 2 tables.

20912 (INS-NUMA—29, pp 124-129) **Significance of proton therapy and its basic study.** Takenaka, Eiichi (Tokyo Univ. (Japan). Faculty of Medicine). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

Protons have a relative biological effect (RBE) as low as that of gamma rays. However, targeting tumors is relatively easy, and the accelerator is small and easy to maintain. A basic study for treating cancer by the irradiation of 52 MeV proton beams was made. The mice irradiated systemically with 1140 rad showed a RBE of 0.72 at LD 50/30. Rabbit's ears were irradiated (irradiation field 3 x 3 cm^2); the maximum tolerance dose was 800 rad. The legs or toes of some of the mice dropped off after the irradiation of 4000 rad, and those of all the mice did after the irradiation of 8000 rad.

20913 (INS-NUMA—29, pp 86-97) **Proton beam therapy by the spot scanning method.** Kouchi, Kiyomitsu; Kanai, Tatsuaki; Matsuzawa, Hideo (National Inst. of Radiological Sciences, Chiba (Japan)); Inada, Tetsuo. Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

A proton beam therapy system was installed at the cyclotron facility of National Institute of Radiological Science. The system consists of a beam port for horizontal proton beam therapy, a spot scanning control apparatus, and a proton therapy irradiation system. The beam in monitored by three monitoring ionization chambers. The spot scanning is controlled by a TOSBAC-40 C computer. The irradiation system comprises a range modulator, a multi-leaf collimator, and applicator, and a position-defining light source. The scanning of beam spot is made by a horizontally and a vertically deflecting electromagnets. The scanning speed at the irradiation position is about 1 cm/m sec. The uniformity of irradiation field is kept for the domain of 18 cm squares. The depth distribution of irradiation dose in water was investigated, and the dose distribution was uniform to the depth of 3.6 cm. This spot scanning system can make the irregular field irradiation, which can be made by the TOSBAC-40 C computer. The trial use of the system has been made since October, 1979.

20914 (NIRS-M—34, pp 151-160) **Pathological problems of cancer of the uterine cervix. Classification for prediction of radiosensitivity.** Ohmi, Kazuo (National Cancer Center, Tokyo (Japan). Hospital). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

Cancers of the uterine cervix were classified for prediction of radiosensitivity. They were classified into two types: radioresistant type (R-type), in which the cancer was predominated by the properties of adenocarcinoma and was radioresistant, and radiosensitive type (S-type) in all others. In preoperatively irradiated cases of stage IIb cancer of uterine cervix, 84% of R-type cases showed viable cancer cells, and 84% of S-type cases showed tumor disappearance. In cases of radiotherapy in a period 1965 - 70, 69% of stage II cases and 70% of stage III cases of R-type showed disease progress; for S-type, 88% of stage II and 77% of stage III cases had tumor control. In stage III cases given radiotherapy alone in 1971 and 1972 after the histological features were examined, 82% of R-type cases showed tumor recurrence and 77% of S-type cases had disease control. Problems in the classification and assessment were discussed.

20915 (NIRS-M—34, pp 298-318) **Hypoxic cell sensitizer.** Onoyama, Yasuto (Osaka City Univ. (Japan). Faculty of Medicine). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

The significance, present status of study and problems of hypoxic cell sensitizer in radiotherapy were examined especially on misonidazole. This drug intensified the radiosensitivity of only the tumors containing hypoxic cells without affecting normal cells. It spreads and permeates from blood vessels to hypoxic cells in the tumor, and the intratumoral concentration is 50 - 80% of the blood concentration. Animal studies in Japan demonstrated that the permeability of this drug into tumors was 70 - 80% of the blood level, and that TCD50 was significantly decreased, producing sensitization rates of 1.2 - 1.3 with 0.1 mg/g and approx. 2.0 with 1.0 mg/g. However, data on the sensitizing effect of fractionated irradiation vary from report to report, and it is a future theme of study. As acute toxicity, the LD50 was approx. 2 mg/g for animals, and in humans, the administration of 0.5 mg/g 3 times per week for 6 weeks resulted in neurotoxicity. Its mutagenicity has been reported. In the phase 1 clinical study, the blood level 4 - 6 hours after the oral administration of this drug in 97 cases was in proportion to the dose; 1.0 g/m^2 produced sensitization rates of 1.4 - 5%, and 2.0 g/m^2 those of 1.6 - 7%. It was effective in approx. 30%, and side effects were noted in 32 cases. the toxicity of this drug to hypoxic cells has also been examined.

20916 (NIRS-M—34, pp 55-65) **Radiodiagnosis of lung cancer. Mode of progress and roentgenological findings of adenocarcinoma.** Suzuki, Akira (Sapporo Medical Coll. (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

Adenocarcinoma of the lung occurring in the periphery grows as superficial spreading and/or deeply invading parts in the alveolar area. The superficial spreading part develops on the internal surface of alveoli, and when this part shows a monolayer arrangement of tumor cells and is low in height, not accompanied by mucus production, the shadow is faint, and does not cause deformation or deviation of the pre-existing structures. When tumor cell have amultilayer, substantial or polyoid arrangement and marked mucus production, the shadow is dense with a clear margin and no change or occasional compression of the pre-existing architecture. The deeply invading part develops on the alveolar wall, manifesting itself primarily as interstitial hyperplasia and fibrosis. Roentogenologically, the part shows a slightly high density and convergence in the pre-existing structures. Each adenocarcinoma shows an architecture consisting of these progressing parts combined and is similar roentogenologically. Therefore, X-ray features such as the density of tumor shadow, marginal properties and presence or absence and the intensity of convergence demonstrate the rough architecture and mode and stage of tumors.

20917 (NIRS-M—34, pp 93-107) **Multidisciplinary treatment of lung cancer, (2). Radiotherapy.** Amino, Saburo; Abe, Kimihiko; Kawana, Koji; Hayata, Yoshihiro (Tokyo Medical Coll. (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

In order to establish a multidisciplinary therapy for lung cancer, the current radiotherapeutic data and the combination of surgery with irradiation or drugs were examined statistically. The data permit anticipation of cure by radical irradiation if the site of onset, histological pattern and morbid stage are taken into consideration. However, selection between radical or palliative irradiation should be examined meticulously. Excessive irradiation induces severe injury. Preoperative irradiation is indicated for tumors invading the surrounding structures, primarily on the thoracic wall, and postoperative irradiation is effective for mediastinal metastasis of squamous cell carcinoma.

20918 (NIRS-M—34, pp 109-126) **Multidisciplinary treatment of lung cancer, (3). Chemotherapy.** Ikegami, Harumichi; Horai, Takeshi (Osaka Prefectural Center for Adult Diseases (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

The current status in Japan of small cell carcinoma and adenocarcinoma for which chemotherapy is frequently used, combination with radiation and indication of chemotherapy were examined. Currently, the combination therapy with 4 drugs is effective in approximately 80% of the cases of small cell carcinoma and approximately 50% of those of adenocarcinoma, tumor regression and prognosis showing a good correlation. The combination with radiation is especially effective for small cell carcinoma. Although the combination therapy with 3 drugs is effective in 63%, irradiation of 200 rad immediately before medication once a week, a total of 800 rad per cycle, was effective in 80% after completion of one cycle. In adenocarcinoma, however, the combination of radiation did not greatly influence the prognosis. The effect of combination also differs according to the cell morphology, and the frequency of appearance of cells with a characteristic nucleus predicts the prognosis. Cellular findings are definitely correlated with the prognosis.

20919 (NIRS-M—34, pp 161-177) **Current status of treatment of cancer of uterine cervix, (1). Radiotherapy.** Arai, Tatsuo; Morita, Shinroku; Murakami, Yuko; Motoya, Yoshifumi (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

High dose rate intracavitary irradiation for cancer of the uterine cervix was examined. The 5-year survival rate of this method showed no significant difference from that of the low dose rate intracavitary irradiation, nor did the onset of regional injury show any difference. The optimal dose for stage 1 and 2 was 2900 +- 300 rad, which was approx. 60% of that of the low dose rate method. Elevation of ESR affected the survival rate only in stage 3 and 4 cases. The 5-year survival rate of cases with normal kidney function was twice that of abnormal cases. Radiotherapy of cancer of uterine cervix produced a 5-year survival rate of 58.8% and a cancer morbidity rate of 33.1%; patients with metastasis cannot be cured. The basic form of dose distribution by intracavitary irradiation was tumbler of Manchester's technique. The radiation source was placed in accordance with the conditions established by this technique, and the dose distribution was corrected with a computer.

20920 (NIRS-M—34, pp 178-188) **Multidisciplinary treatment of cancer of uterine cervix, (2). Surgical therapy.** Kasamatsu, Tatsuhiro; Sonoda, Takahiko; Tanemura, Kenjiro; Ohmi, Kazuo; Matsumoto, Yoshi (National Cancer Center, Tokyo (Japan). Hospital). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

Okabayashi's extensive panhysterectomy is used for cancer of uterine cervix in Japan, and the rate of its practice was 45.6% at the National Cancer Center (1962 - 73, stage 1 - 4 cases). Cancer death within 5 years occurred in 92.3% of the total deaths, and the total surgical deaths did not exceed 1%. Postoperative irradiation was performed in cases with lymph node metastasis, those with parametrial invasion and those with deep primary lesions. Intravaginal irradiation was sometimes performed in cases of insufficient vaginal excision. Therefore, the 5-year survival rate of postoperatively irradiated cases was 71.4%, and that of non-irradiated cases 93.7%. The 5-year survival rate of all cases of adenocarcinoma including irradiated cases was 44.7%. Since the effect of irradiation was not so promising, postoperative irradiation with fast neutrons is performed in adenocarcinoma cases with metastasis and/or infiltration. Effect of combination with chemotherapy has been poor. The indication of less surgery for early cases is under examination.

20921 (NIRS-M—34, pp 189-196) **Treatment of recurrent or metastatic carcinoma of the uterine cervix, (1). Radiotherapy.** Kawahara, Yoshiko; Miyazaki, Machiko; Saito, Yasuo; Okawa, Tomohiko; Ikeda, Michio; Tasaki, Hideo (Tokyo Women's Medical Coll. (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

Subjects were 66 patients with local recurrence within 5 yr of initial treatment and 77 with distant metastasis. Radiotherapy was given in 52 cases of local recurrence and 44 of distant metastasis. The method of irradiation slightly differed according to the method of initial treatment. Of the patients with distant metastasis, 80% (35/44) died within 1 yr, and 4 survived for more than 2 yr. Of the patients with local recurrence, 63% (33/52) died within 1 yr, and 7 survived for more than 3 yr. Only one of these 7 survivors had received external irradiation alone, and the remaining 6, combination of external irradiation with intravaginal or interstitial irradiation. None of the patients with local recurrence who was initially treated with radiation survived for a long period. Three of patients with local recurrence and one with distant metastasis survived for 5 yr, amounting to a 5-yr survival rate of 5.5% (4/73).

20922 (NIRS-M—34, pp 229-248) **Physical approach, (1). Particle radiotherapy.** Tsunemoto, Hiroshi; Morita, Shinroku; Arai, Tatsuo; Nakamura, Yuzuru (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

Particle radiotherapy was introduced to enhance the effect on cancers and to improve the dose distribution. Biologically, it is effective for hypoxic cancer cells and cancer cells under active recovery from radiation injury. The effect appears uniformly in all cell phases. This therapy is superior to the conventional radiotherapy for carcinoma of the head and neck, does not show great differences for carcinoma of the esophagus, lung or uterine cervix. This method shows an excellent effect on osteosarcoma. For malignant

melanoma, reduction of the surgical area by preoperative irradiation is under study. The dose distributions of protons, $^{-}\pi$ mesons and heavy ions are much better than that of fast neutrons so that injury of normal tissues is remarkably reduced. The dose distribution of protons is best, and the method is appropriate for the treatment of malignant melanoma of the chorioidea. Although the therapeutic effect of high LET radiations is thought to be also demonstrated with heavy ions and $^{-}\pi$ mesons which show an excellent dose distribution and a characteristic biological effect, it requires the precise diagnosis of tumors and utilization and management of the equipment.

20923 (NIRS-M—34, pp 319-326) **Hyperthermia.** Nakamura, Wataru (Aichi Cancer Center, Nagoya (Japan). Research Inst.). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

In comparison with the effect of radiations, hypoxic cells were more thermolabile, and decrease in pH elevated the fatality by heat. As for the sensitivity in the cell cycle, the S phase was resistant against radiations, but sensitive against heat. Cells under growth showed low radiosensitivity in the non-proliferating phase, but showed a reverse relation by heat. Some chemical compounds with a SH group increased heat-sensitivity, as did radiations. Injury generally occurred and was completed in the same cell cycle. The interval between injury and recovery was 9 hr. for G1 phase cells and 18 hr. for S phase cells. Target agents are unknown, but protein and its analogues have been postulated. Combination with radiations brought sublethal to lethal injury of non-synchronized culture cells and showed a synergistic-totalling effect in animal studies. Radiosensitization by heat was pronounced only in tumors, and the optimal interval of treatment was 3 - 4 hr. The temperature of normal tissues stopped rising at about 43°C, but the intratumoral temperature continued to rise. Tumor regression was observed in cases of marked thrombocytopenia which occurred after thermal treatment.

20924 (NIRS-M—34, pp 249-269) **Slow neutron capture therapy for malignant glioma (boron or lithium neutron capture therapy).** Hatanaka, Hiroshi (Teikyo Univ., Tokyo (Japan). Faculty of Medicine). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

In recurrent glioblastoma, the mean survival period is approx. 6 months by the routine methods of treatment, but is extended more than 3-fold by neutron capture therapy. This method and a routine method with ^{60}Co or an accelerator were used for comparison in the clinical treatment of 26 patients with supratentorial malignant glioma. There were no significant differences as for prognostic factors of the group treated by this method and those of the control group; No. of cases 14 and 12, the mean age 46 and 53.5 yr, and the stage (TNM) 3.14 and 2.83, respectively. As of the end of Feb. 1980, this method showed a lifeprolonging effect 3 times that of the control, the mean survival period being 67 weeks for this method and 21 for the control. Although 100% improvement was observed in about one half of the cases by this method, the control group showed improvement of only 80% at maximum. It is also possible to treat any deep portion of the brain with thermal neutrons. As a Boron compound, mercaptoundecahydrododecarborate with a low toxicity has been put into practical use for brain tumors, and as Li, the use of ^{6}LiCl for lung cancer is under examination.

20925 (NIRS-M—35, pp 329-341) **In vivo measurement of thyroidal iodine content by x-ray fluorescent technique.** Imamura, Keiko (St. Mariana Univ., Kawasaki (Japan). School of Medicine). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Thyroidal iodine content gives useful information in the fields of physiology, clinical medicine, health physics etc. Iodine content has been determined mainly for resected thyroids. Recently, x-ray fluorescent analysis has been extended as the in vivo technique first in the clinical medicine. Exciting sources used for the analysis of the thyroid are Am-241 or x-ray tube. Am-241 has a half-life of 438 years and emits γ-ray of 60 keV. Thyroid can be imaged by fluorescent scan utilizing strong (10 - 15 Ci) Am-241 source. Examination time is about 15 min and the radiation dose to the gland is about 15 - 60 mrad. Iodine content is determined by static fluorescent technique equipped with weaker source of less than 1 Ci. Thyroidal iodine content in normal subjects was analysed by this technique and the results were in good accordance with those obtained by in vitro analysis. Difference in the thyroidal iodine content between the Japanese population and other countries is not clear. Application to the pathological cases has provided many findings about the iodine content and its distribution which could not be obtained by in vitro analysis. This in vivo technique can be safely performed for infants and for pregnancies, and the relatively compact size of this apparatus could be widely used in the study of health physics and environmental problems.

20926 **Characteristics of I-125 4-IQNB and H-3 QNB in vivo and in vitro.** Gibson, R.E.; Weckstein, D.J.; Jagoda, E.M.; Rzeszotarski, W.J.; Reba, R.C.; Eckelman, W.C. (George Washington Univ. Medical Center, Washington, DC). *Journal of Nuclear Medicine;* **25**: No. 2, 214-222(Feb 1984). Contract AS05-82ER60039.

The accumulation of (R)-(H-3)-3-quinuclidinyl benzilate (H-3 QNB) and (R,S)-1-azabicyclo(2.2.2)oct-3-yl (R,S)-alpha-hydroxy-(4-[I-125]iodophenyl)benzeneacetate (I-125 4-IQNB) in heart, caudate/putamen, and cerebellum of rats was determined at intervals from 15 min to 4 hr after injection. The behavior of the two radiotracers in the heart is consistent with in vitro results with respect to affinities and specificities. In the brain, however, the compounds differ in tissue selectivity. At high specific activity, neither compound provides localization that is consistent with the concentration of receptor in the tissues. The results of this study do not indicate quantification of receptor concentration by means of single external images.

20927 **Improved intrinsic resolution: does it make a difference? concise communication.** Hoffer, P.B.; Neumann, R.; Quartararo, L.; Lange, R.; Hernandez, T. (Yale Univ. School of Medicine, New Haven, CT). *Journal of Nuclear Medicine;* **25**: No. 2, 230-236(Feb 1984).

The purpose of this study was to determine what effect further improvement in an Anger camera's intrinsic resolution has on lesion detection. We studied 52 patients undergoing bone imaging and 58 undergoing liver imaging. All patients had images performed in rapid sequence on ZLC-75 and ZLC-37 Anger cameras, both by Siemens. The two imaging systems are virtually identical except for the number of photomultiplier tubes and crystal thickness; these resulted in differences in intrinsic resolution and sensitivity. Observer performance, measured by ROC curves, for detection of abnormalities was virtually identical with the two instruments. Subjectively, there was a trend toward preference of the ZLC-75 images, but this was not associated with any significant improvement in lesion detectability even in the subgroup in which a preference for one or the other instrument was noted.

5507 Microbiology

REFER ALSO TO CITATION(S) 19872, 19882, 19884, 20875, 20877, 20879, 20880, 20883, 20885, 20939

20928 **Basic biology of new developments in biotechnology.** Hollaender, A.; Laskin, A.I.; Rogers, P. (eds.). New York, NY; Plenum Press (Sep 1983). 575p. OTHER PPNY, 223 Spring ST, New York, NY. Contract FG02-82ER12067.

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

Proceedings of the symposium, held May 25-28, 1982 at the University of Minnesota, Minneapolis, entitled The Biological Basis of New Developments in Biotechnology. The application of basic knowledge in genetics and chemistry to new industrial processes based on recombinant DNA and related enzyme technologies indicates that future advances in biotechnology will be closely linked to fundamental work in the biological sciences. Continued progress in this field will clearly depend upon increased understanding of the

underlying genetic mechanisms, biological processes, and microbial physiology and interactions. Specific topics covered are proteins, peptides, and genes for medicine; lymphoid cells and monoclonal antibodies in biomedical technology; biotechnology for agriculture; drugs and antibiotics; fuels and chemicals; industrial and applied microbiology; and biodegradation and enzyme technology. This multidisciplinary work presents new paths for microbiologicsts, biochemists, and those involved with biotechniques and bioengineering to explore.

20929 **Mutasynthesis and directed biosynthesis for the production of new antibiotics.** Claridge, C.A. (Bristol-Myers Co., Syracuse, NY). pp 231-269 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

Many natural antibiotic fermentations can and have been modified to cause the formation of new secondary metabolites. The full potential of these procedures has yet been exploited by many industrial laboratories. Mutasynthesis, or Mutational Biosynthesis denotes the concept that an exogenous moiety is needed for the synthesis of a secondary metabolite by a mutant of the producing organism. By Directed Biosynthesis, we mean the addition to the fermentation medium of an analog of a part of the antibiotic molecule which the organism is then capable of incorporating into its enzymatic processes to yield a modified antibiotic. Progress in using these two new approaches in developing new and improved antibodies, antimetabolites and neoplastic drugs is reviewed. There are numerous other examples of secondary metabolite expression that can be cited as fruitful endeavors for the resourceful applied microbiologist.

20930 **Host/vector systems for actinomycetes and applications to strain development.** Westpheling, J. (Harvard Univ., Cambridge, MA). pp 271-285 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

Tools are now available in Streptomyces which allow for the manipulation of this organism to improve fermentation efficiency, to generate new strains with desirable phenotypes including improvements of its antibiotic-producing abilities and to study at the molecular level its developmental mechanisms of regulation. Our approach was to isolate a cell fraction from Streptomyces which contains RNA polymerase activity and test this activity in an in vitro transcription assay (run-off assay). DNA, cut at a restriction site downstream from a known promoter, is incubated in the presence of RNA polymerase and a transcrip is generated. RNA of defined lengths were produced which were sized by polyacrylamide gel electrophoresis. Two promotors used in this study were veg and spoVC. The veg gene is transcribed during vegetative growth in Bacillus and the spoVC is transcribed during an early stage of sporulation. The spoVC promoter is not recognized or transcribed by the vegetative RNA polymerase (containing sigma 55) but is transcribed by a novel form of RNA polymerase containing sigma 37.

20931 **Genetic strategies in strain design for fermentations.** Walker, G.C. (Massachusetts Inst. of Technology). pp 349-376 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

A review of genetic strategies that have proven useful in genetic manipulation of Escherichia coli is presented. Particularly, attention is focused on applications of insertion mutagenesis and on the use of operon fusions. The prospects and problems of extending genetic manipulation to strains of Clostridia having potential industrial applications for chemical production and to methanogenic bacteria are discussed.

20932 **Anaerobic production of chemicals.** Linden, J.C.; Moreira, A. (Colorado State Univ., Fort Collins). pp 377-403 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

The incorporation of unsaturated fatty acids was effective in making yeast tolerant to ethanol. Populations of yeast with membranes enriched with linoleic [18:2] residues are reported to exhibit greater viability and a lower extent of nutrient uptake inhibition in 1.0 M ethanol than did yeast enriched in oleate [18:1]. Because of their simplicity, such biochemical approaches may be practiced before the potential of genetic engineering can be realized for improvement of alcohol tolerance. Indeed, the mechanism of alcohol toxicity must be understood through fundamental work in order to know whether a specific gene product could be the target of the genetic approaches.

20933 **Obligate methane-oxidizing bacteria and their biotechnological potential.** Whittenbury, R.; Dalton, H. (Univ. of Warwick, Coventry, England). pp 439-460 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

The properties and present taxonomic status of the obligate methane oxidizing bacteria are described. Methane-monooxygenase, the enzyme involved in the first step of the oxidation of methane to carbon dioxide, is discussed in detail with particular reference to its ability to insert oxygen into a wide range of compounds, such as ammonia, carbon monoxide, methanol, ethanol, alkanes, alkenes, dimethyl and diethyl-ether, alicyclic, aromatic and heterocyclic compounds. This widespread hydroxylase activity is a characteristic of all methane monoxygenases studied, though some are less catholic than others. The biotechnological potential of this enzyme is discussed and other potential biotechnological applications of methane oxidizers are mentioned.

5508 Morphology

REFER ALSO TO CITATION(S) 21116

5509 Pathology

REFER ALSO TO CITATION(S) 20883, 21065

20934 **(ABCC—05-59) Hypocatalasemia: a new genetic carrier state.** Takahara, Shigeo; Hamilton, H.B.; Neel, J.V.; Kobara, T.Y.; Ogura, Yoshio; Nishimura, E.T. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Oct 1960. Contract AC01-76EV03081. 31p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008133.

A clinical, biochemical and genetic study has been made of a rare hereditary disease, acatalasemia, characterized by the absence of activity of the enzyme catalase from the blood and other tissues. Clinically, about half of the acatalasemics suffer from a peculiar type of oral gangrene (Takahara's disease) in childhood. This disease, sporadically distributed throughout Japan, is as yet unreported elsewhere in the world. To date 38 acatalasemics in 17 sibships are known. The high incidence of consanguineous marriages between the parents of the affected persons, the normality of the parents, and the ratio of affected to normal in segregting sibships indicate that the acatalasemia phenotype is recessively inherited. Heterozygotes for this disease have now been identified using a biochemical assay for red blood cell catalase activity; the mean activity (K/sub cat/ in this report) of a normal control group is 5.38 units while that of the heterozygotes is 2.17, and no overlap in values between the two groups has been found. The identification of this carrier state would thus place the gene responsible for acatelasemia in the category of an incompletely recessive (or incompletely dominant). In one of the six families studied, no carrier state could be demon-

strated. There are apparently no clinical manifestations in the heterozygotes. 46 references, 4 figures, 3 tables.

20935 **(ABCC—07-59) Autopsied case of Letterer-Siwe's disease.** Takamura, Tsugiso; Oda, Tomio. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 Jul 1960. Contract AC01-76EV03081. 20p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008445.

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The clinical course and pathological findings of an 11 month old infant with progressive, fatal Letterer-Siwe's disease have been described. 37 references, 4 figures.

20936 **(ABCC—09-64) Frequency and position of pineal gland calcification in a Japanese population.** Hattori, Fumio; Ishimaru, Toranosuke; Russell, W.J.; Kogure, Takashi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 23 Apr 1964. Contract AC01-76EV03081. 12p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008404.

A review of all skull roentgenograms of 525 normal patients was conducted to determine the incidence of pineal gland and habenular nucleus calcification, and to compile normal values for pineal gland calcification in a Japanese population. These data are presented as tables and graphs for use in roentgenological interpretation. 17 references, 2 figures, 5 tables.

20937 **(ABCC—19-64) Experiences with stool benzidine tests in a health survey program.** Sagan, L.A.; Seigel, D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 6 Jul 1964. Contract AC01-76EV03081. 12p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008395.

The screening of a healthy population by the benzidine hydrochloride test is reported. Research was conducted as a part of the study of late effects of radiation in survivors of the atomic bombings of Hiroshima and Nagasaki. Of persons in all age groups, 15% were positive. When the benzidine test was repeated at a 2-year interval those positive on the 1st occasion had only a slightly greater tendency to be positive than those who had been negative on the 1st occasion. Positive benzidine tests have only very slightly higher frequency among persons with intestinal parasites than those without. Anemia was not found among persons with positive benzidine tests. Extensive investigations of 69 otherwise healthy persons who had strongly positive tests failed to reveal disease. Among 209 autopsied persons whose premortem records were examined, the benzidine test was not sufficiently sensitive to be of clinical usefulness. It is concluded that the stool benzidine test is not useful as a screening technique. 15 references, 7 tables.

20938 **Correction of inborn errors of metabolism by bone marrow transplant.** Krivit, W. (Univ. of Minnesota, Minneapolis). pp 63-76 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

A new development in medicine is the utilization of bone marrow transplantation for correction of inborn errors of metabolism. In the past, bone marrow transplantation had been utilized for the curative treatment of aplastic anemia, leukemia, neuroblastoma, and congenital immune and hematologic deficiencies. The new concept espoused here is that inborn errors of metabolism of enzyme deficiency can be effectively treated with bone marrow transplant. The report by Hobbs in the Hurler patients and mucopolysaccharidosis cases indicated that their patients have developed normal levels of enzyme in plasma and urine and in leukocytes. This, therefore, is evidence of a bone marrow take from the donor in the bone marrow transplant process. This was to be anticipated and provides another method of proving that recipient cells are derived from the donor.

20939 **Monoclonal antibody for the protection of neonatal pigs and calves from toxic diarrhea.** Sadowski, P.L. (Univ. of Saskatchewan, Saskatoon); Acres, S.D.; Sherman, D.M. pp 93-99 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

A monoclonal antibody reactive with the K99 pilus protein and not crossreactive with any other E. coli components has been shown to be efficacious in protecting neonatal animals from death due to enteropathogenic K99(+) E. coli. This antibody is effective when administered orally, and establishes the importance of E. coli adhesins to pathogenicity in the intestinal tract.

5510 Physiological Systems

20940 **Quantitative analysis of the cytokinetic response of KHT tumors in vivo to 1-β-D-Arabinofuranosylcytosine.** Pallavicini, M.G.; Gray, J.W.; Folstad, L.J. (Lawrence Livermore National Lab., CA). *Cancer Research;* **42**: 3125-3131(Aug 1982). Contract W-7405-ENG-48.

Quantitative estimates of cytokinetic perturbations induced over a 30-hr interval in KHT tumor cells in vivo by a single dose of 1-β-D-arabinofuranosylcytosine (ara-C) were inferred from measurements of DNA distribution sequences, tritiated thymidine incorporation into tumor cell DNA, and radioactivity of cells labeled with tritiated thymidine prior to treatment with ara-C. These data were analyzed collectively to produce a mathematical model describing the effects of ara-C on tumor cell cycle kinetics. During analysis, we postulated that ara-C produced a transient block at the a G_1-S-phase boundary, that ara-C killed all cells in S phase, and that the cells killed by ara-C did not cycle after treatment. The analysis showed that the duration of the G_1-S-boundary block was 5.5 hr, that cells were recruited from G_0 into cycle beginning 5.5 hr posttreatment, and that the G_1, S, and G_2M phase durations of the clonogenic cells which were initially 2, 11.5, and 2 hr, respectively, changed to 0.8, 4.6, and 0.8 hr at 14 hr posttreatment. Cells killed by ara-C were removed from the tumor beginning 10 hr posttreatment. We then used the mathematical model to predict clonogenic tumor cell survival following a second dose of ara-C administered at time intervals ranging from 1 to 30 hr after the first treatment. Clonogenic tumor cell survival following the second dose of ara-C was then experimentally determined and agreed well with the model predictions.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 20882, 20939

20941 **(IAEA-R—2596-F) Sandy soil plantation in semi-arid zones by polyacrylamide gel conditioner prepared by ionizing radiation. Part of a coordinated programme on radiation modified polymers for biomedical and biochemical applications. Final report for the period 1 July 1979 - 31 August 1983.** Azzam, R.A.I. (International Atomic Energy Agency, Vienna (Austria)). Jul 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700757.

Polyacrylamide gel prepared by ionizing radiation was found to be capable of furnishing adequate conditions for sandy-soil plantation in semi-arid zones. The gel can be tailored for any soil texture under various climatic conditions. The sand-gel combination maintains three cycles of complete destruction and reformation without significant changes in erosion index. Water holding capacity and retention at different suctions in treated sand are increased. This increases water use efficiency. Fertilizers use efficiency is also increased to almost three times that of fertile clay soil.

20942 (Zfl-Mitt—69, pp 114-150) **Evaluation of mixing of particulate solids by radiotracer method.** Thyn, J. (Inst. for Research, Production and Applications of Radionuclides, Prague (Czechoslovakia)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Labelling of loose powder particles is briefly discussed and four applications of radiotracer methods in mixing studies of fodder are mentioned: determination of homogenization time by continuous detection method, evaluation of flow characteristics and of sequence of particulate solids discharging from silos, evaluation of segregation of mixtures in silos, and evaluation of equalization ability in a continuous gravity blender.

20943 **New developments in plant tissue culture and plant regeneration.** Green, C.E. (Univ. of Minnesota, St. Paul). pp 195-209 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

A dominant mutation, Ltr*-19, conditions the overproduction of the nutritionally essential amino acid, threonine, in tissue cultures of corn and most importantly in the seed of regenerated plants and subsequent generations. The magnitude of threonine overproduction in seed carrying Ltr*-19 suggests an important opportunity to isolate and use amino acid overproducer mutants to selectively increase the levels of specific nutritionally limiting amino acids in seeds. In light of these results, it is clearly desirable to isolate lysine, tryptophan, and methionine overproducer mutants in various crops.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 21132

20944 **(ABCC—1-65) Operations manual for the detection of leukemia and related disorders, Hiroshima and Nagasaki.** Finch, S.C.; Hoshino, Takashi; Hrubec, Z.; Itoga, Takashi; Nefzger, M.D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Jan 1965. Contract AC01-76EV03081. 60p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008148.

This Manual contains a description of the internal operations at ABCC for the detection of leukemia and related disorders. It also outlines the role of the hematologist and the mechanisms for storing histologic materials and pertinent medical information. It is hoped that this Manual will be a useful guide for the medical staff at ABCC and that it will help to provide uniformity in the hematology investigation programs at Hiroshima and Nagasaki. 5 references, 13 figures.

20945 **(ABCC—2-65) Ultrastructural studies of spleen after whole-body irradiation.** Jordan, S.W. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1965. Contract AC01-76EV03081. 20p. (In Japanese and English). (TID—22537). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008103.

The ultrastructural changes in mouse spleen during the first 6 days after 800 r of whole-body irradiation have been described. Mature lymphocytes showed early cytonecrosis, characterized by marked cellular shrinkage without fragmentation and usually were phagocytized whole by reticular macrophages, subsequently fragmented and were digested. Immature lymphocytes showed chromatin clumping, in addition to cytonecrotic changes like those in mature lymphocytes but appeared less sensitive to radiation than mature lymphocytes. There was mild dilatation of endoplasmic reticular cisterns in plasma cells, but reticular macrophages, megakaryocytes and fibroblasts appeared to be directly affected relatively little by radiation. 18 references, 16 figures.

20946 **(ABCC—3-66) Rheumatoid arthritis - Hiroshima and Nagasaki: prevalence, incidence, and clinical characteristics.** Wood, J.W.; Kato, Hiroo; Johnson, K.G.; Uda, Yutaka; Russell, W.J.; Duff, I.F. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 25 Apr 1966. Contract AC01-76EV03081. 19p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008085.

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Rheumatoid arthritis occurring between 1958 to 1964 in a fixed population of about 16,000 in Hiroshima and Nagasaki, Japan is reported. The prevalence of definite rheumatoid arthritis was 0.35% and the estimate of incidence was 45 per 100,000 per year. Subjects with rheumatoid arthritis had an increased frequency of AB and a decreased frequency of O blood group as compared with the total study population. No relationship was detected between the disease and exposure to the atomic bombs. Clinical observations and laboratory data are presented. 23 references, 2 figures, 10 tables.

20947 **(ABCC—6-64) JNIH-ABCC Life Span Study, Hiroshima and Nagasaki: characteristics of the sample.** Ishida, Morihiro. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Mar 1964. Contract AC01-76EV03081. 55p. (In Japanese and English). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008448.

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Four topics related to the sample characteristics of the LSS are intensively discussed: (1) Influence on characteristics and mortality due to an artificial criterion which restricted the Life Span Study sample to a certain honseki area. (2) Comparison of characteristics and mortality between the Adult Health Study sample selected from the Life Span Study sample, and the remaining portion of the Life Span Study sample. (3) Comparison of characteristics and mortality among three subsamples of the Hiroshima not-in-city component of the Life Span Study originating from three different census lists. (4) Migration patterns of the Life Span Study with consideration of various variables. 12 references, 10 figures, 30 tables.

20948 **(ABCC—00-60) Bibliography of published papers of the Atomic Bomb Casualty Commission.** (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Jan 1961. Contract AC01-76EV03081. 7p. (In Japanese and English). NTIS, PC A02/MF A01. Order Number DE84008450.

Bibliographic information is presented for 245 papers published during 1960 dealing with the atomic bomb survivors from Hiroshima and Nagasaki. (DMC)

20949 **(ABCC—00-61) Bibliography of published papers of the Atomic Bomb Casualty Commission.** (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1961. Contract AC01-76EV03081. 7p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008459.

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A bibliography containing information about papers published under the sponsorship of the Atomic Bomb Casualty Commission (ABBC) during 1961 is presented. (DMC)

20950 **(ABCC—01-61) ABCC-JNIH Adult Health Study Hiroshima, 1958 to 1959. Hypertension and ischemic heart disease.** Switzer, S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Nov 1963. Contract AC01-76EV03081. 28p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008157.

The interrelations of hypertension, ischemic heart disease, blood lipid levels and ionizing irradiation were investigated among 1051 male and 1872 female members of the ABCC-JNIH Adult Health Study. No significant effect of ionizing irradiation upon the cardiovascular system were detected. No major difference in age-sex specific mean blood pressures between Adult Health Study subjects and a suitable American comparison group was found. An accelerated course with fulminating vascular deterioration was suspected in only 1% of the hypertensive subjects. As a result, advanced retinopathy and renal failure were rarely seen. Electrocardiographic evidence of left ventricular hypertrophy occurred in 7.2% of the hypertensive subjects in this study, and was readily

correlated with ambient systolic blood pressure. Evidences of ischemic heart disease and congestive failure were rare and distinctly less common than in American males unselected as to blood pressure levels. In contrast, mortality statistics indicate cerebrovascular disease to be at least as common in Japan as in the United States. Adult Health Study data exhibit low serum cholesterol concentrations by Western standards and elevated levels are predominantly limited to the obese. Both factors appear of importance in the occasional hypertensive subject with ischemic heart disease. The therapeutic implication of this observation is briefly discussed. 57 references, 10 tables.

20951 **(ABCC—01-63) JNIH-ABCC Life Span Study. Report 2. Mortality in selection I and II, October 1950-September 1959.** Jablon, S.; Ishida, Morihiro; Beebe, G.W. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 23 Jan 1963. Contract AC01-76EV03081. 48p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008158.

The present JNIH-ABCC Life Span Study is based on a sample of about 100,000 persons consisting of survivors 0 to 2499m of the hypocenter together with persons more distally located and persons not present in either city ATB. Followup is maintained by consulting official family registers kept by local authorities in Japan. Mortality rates calculated from the present data agree fairly well with Japanese national rates for 1955. Total mortality rates are not grossly different between survivors who were located at various distances, but nonexposed persons, especially males, have much lower mortality rates than do survivors. This difference is attributable to much lower mortality from tuberculosis. Leukemia mortality rates calculated from the present data confirm the well known facts as to the leukemogenic effects of radiation from the atomic bombs on survivors. Mortality from malignant neoplasms other than leukemia found by the present study differs in major ways from what would be expected from data of the Hiroshima Tumor Registry previously published by Harada and Ishida. Instead of a general increase of rather large magnitude in tumors of all sites among heavily irradiated survivors, an effect of moderate magnitude (though quite definite) is found among Hiroshima females. Among survivors nearest the hypocenter no convincing evidence was found of elevation in mortality rates for natural causes exclusive of neoplasms. Definitely increased death rates for aplastic anemia were found, especially in Nagasaki. This probably results from diagnostic difficulties in distinguishing between this disease and leukemia. Mortality from tuberculosis was elevated among male survivors 0 to 1399m in both cities, but especially in Hiroshima. 13 references, 14 figures, 16 tables.

20952 **(ABCC—01-64) Roentgenographic appearance of ossification centers in the Japanese fetus, stillborn and neonatal death infants, Hiroshima and Nagasaki.** Kawamoto, Sadahisa. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1964. Contract AC01-76EV03081. 14p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008428.

A roentgenographic study of the presence of the ossification centers has been made on a total of 235 cases of miscarriage, therapeutic abortion, stillbirth and neonatal death according to criteria of sex, length of gestational age, and weight at birth. The cases were aged from 16 to 42 gestational weeks. The weight of the cases ranged from 110 g to 3780 g at birth. The order of appearance of the eight centers in fetal life was as follows: Ischium, pubis, calcaneus, talus, distal epiphysis of femur, hyoid, proximal epiphysis of tibia, and cuboid bone. Some of the eight ossification centers appeared earlier in girls than in boys of the same gestational age and birth weight. The osseous development of Japanese fetuses and infants weighing over 2000 g was judged less mature than in similar Caucasian and Negro subjects. 10 references, 1 figure, 6 tables.

20953 **(ABCC—02-59) Leukemia in Hiroshima atomic bomb survivors.** Heyssel, R.; Brill, A.B.; Woodbury, L.A.; Nishimura, Edwin T.; Ghose, Tarunendu; Hoshino, Takashi; Yamasaki, Mitsuru. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Mar 1959. Contract AC01-76EV03081. 74p. (In Japanese and English). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008093.

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This report is intended to provide the basic data pertinent to the leukemia experience observed in the survivors of the Hiroshima atomic explosion. Many of the conclusions in this report are tentative. The one clear fact to emerge is that radiation increases the occurrence rate of leukemia and that the magnitude of increase is dependent on dose received. Additional observations can be made, which, while not definitive in themselves, seem to complement each other, and are corroborated by other experiences in radiation biology. From the data a linear relationship between dose and incidence of leukemia is found. The shape of the relation in the lower dose range is not known with certainty. An approximate minimum time for the appearance of leukemia following radiation is 3 years or less. The data suggest that the time of maximum risk of leukemia may be dependent on the dose of radiation received. In this group the mean latent period is found to lie in the interval between 4 and 8 years following exposure. The length of time during which the increased incidence of leukemia persists is not known. The incidence of the acute leukemias and of chronic granulocytic leukemia is increased in the exposed survivors. The chronic granulocytic variety is disproportionately increased in Japanese survivors of the atomic bomb. No effect of radiation on monocytic or chronic lymphatic leukemia incidence is noted. Aplastic anemia, polycythemia vera, and myelofibrosis have been investigated. Myelofibrosis is the only one of this group of diseases in which a suggestive relation to radiation exposure is apparent. The natural history of leukemia following radiation does not seem to differ from that of the spontaneously occurring variety. 17 references, 5 figures, 38 tables.

20954 **(ABCC—02-60) Statistical aspects of the program of the Atomic Bomb Casualty Commission.** Beebe, G.W. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 24 Feb 1961. Contract AC01-76EV03081. 35p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008077.

The Atomic Bomb Casualty Commission (ABCC) is a medical research institute in Hiroshima and Nagasaki devoted to long term study of the late effects of nuclear radiation upon man. The work draws its great interest from the paucity of existing information on the effect of radiation on man; from the unique radiation experience of the atomic bomb survivors; from the increasing utilization of nuclear energy in modern technology; and from humanitarian concern for the survivors of the bombs. The ABCC program provides the statistician with an important opportunity to apply the tools and concepts of statistics, for the inferences to be drawn are largely statistical inferences growing out of the comparison of samples defined as to radiation exposure. The work is of international as well as statistical interest by virtue of its subject matter and as a meeting-ground for statisticians trained in different countries.

20955 **(ABCC—02-61) Tumor registry study in Hiroshima and Nagasaki: research plan.** Ishida, Morihiro; Zeldis, L.J.; Jablon, S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Jan 1961. Contract AC01-76EV03081. 21p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008101.

The tumor registry program is conceived as a contribution to knowledge concerning possible radiation-produced carcinogenesis among human populations. Its specific purpose is to ascertain whether or not the incidence of malignant neoplasms is higher among A-bomb survivors than in nonexposed Hiroshima and Nagasaki populations. Tumor registry data also provide useful information for the conduct of other aspects of the ABCC Unified Study Program, including specific information on occurrence of neoplasms in individuals registered in the Adult Health Study, and comparative epidemiologic data for pathology analyses. 4 figures.

20956 **(ABCC—02-63) Illness episodes and A-bomb exposure: a study of absenteeism among Nagasaki Mitsubishi Shipyard workers.** Komatsu, Teizo; Hashimoto, Takeaki; Onishi, Shigeyuki; Fujisawa, Hideo. (Atomic Bomb Casualty Commission, Nagasaki (Japan)). 23 Jan 1963. Contract AC01-76EV03081. 25p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008102.

With rate, frequency, and length of absence as indices, a study of the relation between A-bomb exposure and health status

was conducted among male workers of the Nagasaki Mitsubishi Shipyard. The following results were obtained: absence rate of the group located 0 to 1999 m from the hypocenter was approximately 0.20 which is practically the same as the rates of the other comparison groups. Within the 0 to 1999 m group, the absence rate of the group with symptoms was higher than that of the group without symptoms. This was not statistically significant, and was ascribed to the effect of absence proneness in the group with symptoms. The absence rate showed a tendency to increase gradually with exposure dose. Within the 0 to 1999 m group, the hospitalization rate of the group with symptoms was significantly lower than that of the group without symptoms. The absence rate for diseases of the digestive system was high among those located 3000 to 3999 m from the hypocenter as well as those not in the city ATB, but in the 0 to 1000 m group the rate was high for diseases of the respiratory system. Between the 3 comparison groups no marked difference was noted in the prevalence rate of diseases which are possibly related to radiation. Of the 52 individuals who had been absent from duty 4 or more days on account of illness during the 2-year period at the Nagasaki Mitsubishi Shipyard, corresponding findings were recorded at the ABCC clinic for 25 (48.1%). 9 references, 2 figures, 18 tables.

20957 **(ABCC—02-64) Malignant lymphoma in survivors of the atomic bomb, Hiroshima.** Anderson, R.E.; Ishida, Kenzo. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Feb 1964. Contract AC01-76EV03081. 18p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008094.

The present study demonstrates an increased prevalence of Hodgkin's disease, lymphosarcoma and multiple myeloma in survivors within 1400 m from the hypocenter in Hiroshima who had surgical or post-mortem examinations at ABCC. Reticulum cell sarcoma appears to have decreased prevalence in this same group. The pathologic material demonstrating these relationships consists of 91 cases of unequivocal malignant lymphoma and is drawn from two essentially independent ABCC sources, the autopsy series and diagnostic lymph node biopsies. A consideration of the epidemiologic characteristics of this material supports the view that the increase in prevalence is a reflection of the occurrence of lymphoma in the general population of survivors within 1400 m of the hypocenter. In addition, among such persons autopsied at ABCC there appears to be a shift to death at an earlier age than is found in the other comparison groups. The possible implications of this are discussed. A comparison of the lymphomas examined shows no morphologic differences in the corresponding diagnostic categories between the various comparison groups. 21 references, 3 figures, 3 tables.

20958 **(ABCC—03-60) Statistical aspects of tumor registries, Hiroshima and Nagasaki.** Ishida, M. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 24 Feb 1961. Contract AC01-76EV03081. 22p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008104.

Statistical considerations are presented on the tumor registries established for purpose of studying radiation induced carcinoma in Hiroshima and Nagasaki by observing tumors developing in the survivors of these cities. In addition to describing the background and purpose of the tumor registries the report consists of two parts: (1) accuracy of reported tumor cases and (2) statistical aspects of the incidence of tumors based both on a current population and on a fixed sample. Under the heading background, discussion includes the difficulties in attaining complete registration; the various problems associated with the tumor registries; and the special characteristics of tumor registries in Hiroshima and Nagasaki. Beye's a posteriori probability formula was applied to the Type I and Type II errors in the autopsy data of Hiroshima ABCC. (Type I, diagnosis of what is not cancer as cancer; Type II, diagnosis of what is cancer as noncancer.) Finally, the report discussed the difficulties in estimating a current population of survivors; the advantages and disadvantages of analyses based on a fixed sample and on an estimated current population; the comparison of incidence rates based on these populations using the 20 months' data of the tumor registry in Hiroshima; and the sample size required for studying radiation induced carcinoma. 10 references, 1 figure, 8 tables.

20959 **(ABCC—03-63) Decline of blood leukocyte counts 1947-59, Hiroshima and Nagasaki.** Ichimaru, Michito; Ueda, Shoichi; Blaisdell, R.K. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 3 Mar 1963. Contract AC01-76EV03081. 13p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008084.

Earlier reports of progressive decline in leukocyte counts in Hiroshima from about 1948 to 1954 have been confirmed. A similar phenomenon has been observed in Nagasaki. Analysis indicates that this decline in white cell count with time is not related to exposure to the 1945 atomic bombs, to sex, to age, to commonly diagnosed diseases, or to the disproportionate influence of a subgroup. The principal white cells affected were neutrophils, lymphocytes and eosinophils. The precise etiologic factors accounting for the decline, and the biological significance of the present lower range of leukocyte values in Hiroshima and Nagasaki remain to be determined. 16 references, 5 figures, 5 tables.

20960 **(ABCC—03-64) Cold pressor test on atomic bomb survivors, Nagasaki.** Sasaki, Tomoyoshi; Sweedler, D.R.; Okamoto, Akira. (Atomic Bomb Casualty Commission, Nagasaki (Japan)). 12 Mar 1964. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008096.

Cold pressor test was performed on a sample of 1156 atomic bomb survivors and other persons (ages ranging between 15 to 81 years) residing in Nagasaki City. Response values differed according to such factors as age, sex, blood pressure and month of examination. The response in systolic pressure increased with age but no evidence was found to support an acceleration of aging by irradiation. The response in diastolic blood pressure showed no change with age, but differed between Comparison Groups during the summer months. However, this was apparently due to some other cause than exposure to the atomic bomb. 25 references, 8 tables.

20961 **(ABCC—04-60) Joint NIH-ABCC life span study of children born to atomic bomb survivors research plan.** Kato, Hiroo; Schull, W.J. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 21 Feb 1961. Contract AC01-76EV03081. 36p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008081.

It is the purpose of this project to undertake comparative studies on the mortality rate of the children of heavily exposed parents and suitable control groups. Details of the program plan are presented. They include the sampling plan which entails: criteria for sampling; method of sample preparation; method of collecting data; and methods of analysis. Organization of study and administrative considerations is also included. 5 references, 4 tables. (DMC)

20962 **(ABCC—04-61) NIH-ABCC pathology studies in Hiroshima and Nagasaki provisional research plan. 1. Description and scope of program.** Zeldis, L.J.; Matsumoto, Y. Scott. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Apr 1961. Contract AC01-76EV03081. 54p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008389.

A proposed program for the conduct of pathology studies within fixed cohorts of Hiroshima and Nagasaki A-bomb survivors is described. It is intended that the program may with appropriate modifications serve as a basis for collaborative efforts by community medical institutions and organizations together with ABCC-NIH in both cities. The report describes the scope of the program, together with epidemiologic aspects of the population base and methods of case procurement, and outlines proposed studies. 36 references, 4 figures, 8 tables.

20963 **(ABCC—04-62) ABCC-NIH adult health study Hiroshima 1958 to 1959 thyroid disease.** Hollingsworth, D.R.; Hamilton, H.B.; Tamagaki, Hideya; Beebe, G.W. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Apr 1962. Contract AC01-76EV03081. 65p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008079.

In the matched sample for the Adult Health Study 5553 participants were examined in the ABCC clinic in Hiroshima, Japan during the sixteen month period from July 1958 through October 1959. Thyroid disease was diagnosed for 169 subjects, 152 of whom were female. Simple nontoxic goiter was the most frequently seen thyroid disorder comprising 47 percent of the total, with a sex ratio of 8 to 1 in favor of females. Hiroshima is a coastal city where iodine deficiencies seem unlikely and the various etiological possibilities responsible for nontoxic goiter were reviewed and discussed. Hyperthyroidism was observed in 16 patients of whom 13 were females. One patient with hypothyroidism and 5 with chronic thyroiditis diagnosed by biopsy were seen in the study. Single thyroid nodules were found in 39 patients; the biopsy diagnoses of 19 were listed, 8 of whom were shown to have thyroid carcinoma. Carcinoma of the thyroid was diagnosed microscopically in 12 patients, constituting 7 percent of the total number with thyroid disorders. It was concluded that thyroid disease in Hiroshima warrants further study and it will be of particular interest to carefully observe the Adult Health Study group for the incidence of thyroid nodules and thyroid carcinoma.

20964 **(ABCC—04-64) Central nervous system in leukemia.** Phair, J.P.; Anderson, R.E.; Namiki, Hideo. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Mar 1964. Contract AC01-76EV03081. 26p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008088.

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The present report summarizes the pertinent clinical and pathologic findings in 165 cases of leukemia in atomic bomb exposed victims autopsied during the period 1949 to 1962 at ABCC in Hiroshima and Nagasaki, Japan. Significant parenchymal hemorrhage occurred most often in acute myelogenous leukemia and was markedly increased in patients dying with high terminal white blood cell counts. Possible mechanisms involved in the pathogenesis of cerebral hemorrhage in leukemia are discussed. Subarachnoid hemorrhage and subdural hematoma were not related to leukocytosis but appeared to be influenced by marked thrombocytopenia. Leukemic infiltrates of a diffuse nature involving the meninges were paradoxically increased in patients receiving adequate chemotherapy. Meningeal tumors did not show this peculiar relationship to therapy and were not found in association with lymphatic leukemia. Infections involving the central nervous system were confined to patients receiving chemotherapy including steroids. 39 references, 3 figures, 4 tables.

20965 **(ABCC—05-61) Life span study. Report Number 1. Description of study mortality in the medical subsample, October 1950-June 1958.** Beebe, G.W.; Ishida, Morihiro; Jablon, Seymour. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 Feb 1961. Contract AC01-76EV03081. 59p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008476.

The Life Span Study is designed to evaluate the late mortality effects of the radiation and other trauma received by the survivors of the Hiroshima and Nagasaki A-bombs. No evidence of higher general mortality was seen in the more heavily irradiated groups. When mortality from specific causes were studied the well known leukemogenic properties of radiation were clearly reflected, but for no other causes of death were radiation effects seen. An apparent effect in the area of anemia seems, at least in part, to result from diagnostic difficulties in the blood dyscrasias, inasmuch as some leukemias were so classified. It is also possible that for the blood forming organs the effects of radiation go somewhat beyond the production of classical leukemia. More intensive study of a very much larger body of data is now under way. 41 references, 1 figure, 22 tables.

20966 **(ABCC—05-62) Growth and development studies Hiroshima and Nagasaki: research plan.** Finch, S.C.; Jablon, S.; Hrubec, Zdenek. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 21 Mar 1962. Contract AC01-76EV03081. 17p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008136.

This report summarizes the research plan for prospective evaluation of growth and development in those exposed to varying amounts of ionizing radiation during childhood or while in utero in Hiroshima or Nagasaki. Some experimental observations are briefly presented to provide background information, and the results of previous studies of growth and development at the Atomic Bomb Casualty Commission (ABCC) are reviewed. Procedures have been described for determining the top of the growth curve for the in utero exposed and the maximum growth and development of those exposed during childhood in comparison to their nonexposed counterparts. Differences in growth and development found between exposed and nonexposed individuals will be analysed in relation to radiation dose, age at time of exposure, sex, and socioeconomic factors. Attempts will be made to determine whether or not abnormalities in visual acuity are increased in those exposed while in utero or during childhood as compared to nonexposed or comparable ages. 23 references, 2 tables.

20967 **(ABCC—06-59) Evaluation of gynecological tumors in the atomic bomb survivors.** Sawada, Hisao. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 Jul 1960. Contract AC01-76EV03081. 17p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008095.

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During a series of routine examinations at ABCC, 1785 exposed women (under 2000 meters from the bomb hypocenter and with major acute radiation symptoms) and 1802 control subjects received physical examinations. Of this group, less than 50% of the married patients accepted pelvic examination as part of the routine physical examination, so that 838 exposed women and 603 controls were examined. Carcinoma of the cervix was the most common neoplasm encountered. Biopsy or autopsy tissue confirmation of the diagnosis was obtained in 9 exposed and in 2 control subjects. When cases, clinically evident but unconfirmed by tissue were added, the total was increased to 11 cases in the exposed and 7 cases in the control. Since fewer control cases accepted pelvic examination, the incidence does not appear increased in the exposed group. (The age of onset of cervical carcinoma was not significantly different between control and radiation-exposed patients.) Only scattered pelvic neoplasms of other types were encountered, but one patient with ovarian thecoma, a tumor reported to be radiation-induced in animals, was seen in the exposed group. These findings from a survey examination emphasize the importance of routine pelvic examination in the detection of major disease, particularly carcinoma of the cervix. Cytologic studies and frequent use of biopsy would be of further value in the detection of this important disease. 8 references, 10 table.

20968 **(ABCC—06-61) Age related changes in erythrocyte A and B antigen strength.** Hollingsworth, J.W.; Hamilton, H.B.; Ishii, Goro. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Nov 1961. Contract AC01-76EV03081. 12p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008399.

The strength of A and B antigens of the erythrocyte, as indicated by agglutinability with dilutions of specific antibody, has been investigated in a group of subjects in Hiroshima. Antigen strength was found to rise to maximal levels at age 25 to 29, and decline with advancing years. Degree of irradiation from the Hiroshima atomic bomb in 1945 did not appear in the limited sample to affect this age-dependent structural property of erythrocytes. Antigen strength of females was somewhat less than that of males for those individuals from 20 to 40 years of age. When compared with group A or B subjects, individuals of group AB demonstrated full strength of both A and B antigens. Since Rh antigenicity also has been reported to change with age, it seems probable that multiple changes in the erythrocyte membrane occur with age. Further investigation into the nature of these changes may be fruitful to an understanding of aging processes at the cellular level. 13 references, 1 figure, 6 tables.

20969 **(ABCC—06-62) Pseudohyperkalemia with thrombocytosis.** Ingram, R.H. Jr.; Seki, Masafumi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 16 May 1962. Contract AC01-76EV03081. 22p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008485.

Two patients with thrombocytosis associated with myeloproliferative diseases are described, one of whom had elevated serum and normal plasma potassium concentrations. Electrocardiographic and clinical evidence of hyperkalemia as well as significant underlying renal disease were lacking. Release of potassium from abnormal thrombocytes during coagulation appeared to explain the pseudohyperkalemia. Also presented are serial observations on serum potassium values and blood platelet counts which returned to normal during busulfan therpay. When unexplained hyperkalemia is seen unaccompanied by electrocardiographic and clinical signs, quantitation of blood platelets and potassium determination on platelet-poor plasma are indicated. 9 references, 4 figures, 2 tables.

20970 **(ABCC—07-61) Cardiovascular studies Hiroshima 1958-1960: Report Number 1. Electrocardiographic findings in relation to the aging process formulation of the problem.** Ueda, Shoichi; Yano, Katsuhiko. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Mar 1961. Contract AC01-76EV03081. 23p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008401.

As a part of ABCC's research program to review the general hypothesis that radiation exposure may accelerate aging processes, a comparative study now is being conducted on the pattern of age changes in electrocardiographic findings for the exposed and controls. In this report, emphasis is placed on the method of formulation of this study for statistical analysis. Two aspects of aging are considered: The frequency of abnormal electrocardiographic findings. Age changes found in normal electrocardiographic tracings. The first problem is an analysis of a three dimensional cross table of prevalence of electrocardiographic abnormalities by age, exposure group and a third factor (for instance, a socioeconomic or physiological factor). In the analysis of the second problem, an aging index was established in order to analyse effectively age changes in the electrocardiographic tracings. After a study of 22 measurements, QRS axis, Q-T interval, R/sub II/, T/sub I/, SV_1, RV_1, and RV_5 amplitudes were selected and their combination was derived to attain the highest correlation with age. Preliminary analysis was conducted for males for whom data collection had been completed. In the results so far obtained, no statistically significant differences were noted between the exposure groups. However, further detailed analysis should be conducted on these data together with data for females which are now being compiled. 18 references, 4 figures, 5 tables.

20971 **(ABCC—07-62) ABCC-JNIH adult health study Hiroshima and Nagasaki 1961 exposure to medical x-ray. Preliminary survey.** Ishimaru, Toranosuke; Russell, W.J. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 16 May 1962. Contract AC01-76EV03081. 27p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008481.

A survey was conducted for three months among subjects seen in the medical clinics of ABCC, Hiroshima and Nagasaki, to determine the extent of medical x-ray received in ABCC and other hospitals and clinics. Emphasis was chiefly methodological to prepare for later studies designed to evaluate the contribution of medical x-ray to total radiation dose received by survivors of the atomic bombings and controls. The frequency, the institution in which the subject received x-ray, as well as the types of exposure were the prime considerations in the survey. The data were analyzed for each city by sex, age, and exposure status. 2 references, 5 figures, 11 tables.

20972 **(ABCC—07-64) Natural history and outcome of antibiotic treatment of urinary tract infections in women: Hiroshima.** Freedman, L.R.; Seki, Masafumi; Phair, J.P. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 23 Apr 1964. Contract AC01-76EV03081. 24p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008470.

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The present report is a review of data collected from 159 women whose positive urine cultures were detected during 4 years of a study of the late medical effects of ionizing radiation emitted during the atomic bombing of Hiroshima. Although there are always uncertainties in a retrospective analysis of data, a number of unusual features of the present series of patients provided the stimulus for undertaking the review. These features included the relatively unbiased nature of the study population, the finding of a group of patients who were untreated for sizeable intervals of time, the long follow-up after treatment and the use of quantitative bacteriologic techniques during the entire period of observation. Although the entire study population was not screened for urinary infection, the age distribution of patients with infections was similar of that found in surveys of the general population. Treatment was considered successful in about 84% of cases when evaluation was based on follow-up cultures approximately 3 months after the administration of antibiotics. When evaluation was based on 18 months or more follow-up after treatment, only about 50% of patients had negative urine cultures. These results were similar to those reported previously in hospital clinic patients. Observations on a small group of untreated patients suggest that for women, the long term results of gram negative urinary tract infections is not significantly altered by a single short course of antibiotic treatment. 27 references, 7 figures, 5 tables.

20973 **(ABCC—08-59) Threshold for somatic radiation effects in man as known at present.** Miller, R.W. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 Jul 1960. Contract AC01-76EV03081. 12p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008480.

A summary is presented on the somatic effects of ionizing irradiation in man. Discussion is presented under the headings: premature aging; small head circumference and mental retardation; cataracts; and leukemia. Most of the findings were obtained from studies of survivors from Hiroshima and Nagasaki. 22 references. (DMC)

20974 **(ABCC—08-61) ME-55 adult medical survey 1950-1953, Hiroshima new series tabulations.** Hollingsworth, J.W.; Beebe, G.W.; Yamasaki, Mitsuru. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 Mar 1961. Contract AC01-76EV03081. 121p. (In Japanese and English). NTIS, PC A06/MF A01; GPO Dep. Order Number DE84008469.

This report was compiled for internal use as basic reference material on the population of patients seen at ABCC under the ME-55 program. These tables afford a means of screening the ME-55 data for suggestions of differences between exposed and nonexposed. This report represents the effort to meet an urgent need for systematic compilation of reference material on medical histories, results of physical examinations, and laboratory data. Such information is of general reference value not only in planning future research projects and analyses, but also in reporting progress of the various investigations currently under way at ABCC. Thus, this set of preliminary tables is intended to be exploratory and provocative rather than decisive. Possible radiation effects are sought on the basis of comparisons of exposed and nonexposed. Apart from any bias which may exist this is a fairly efficient approach, since the exposed were chosen from those within 1500 meters of the hypocenter at the time of the bomb (ATB). However, in the first examination cycle under the ME-55 program age-distributions of the exposed and nonexposed were not homogeneous within sex, and for more refined comparisons both age and sex must be taken into account. Finally, the first cycle ME-55 examination is said to have been attended with a low attrition rate. Overall figures on the original sample are provided. A later adjustment in the ME-55 sample reduced the count from 4196 to 4082 patients examined in the first cycle. 15 references, 1 figure, 107 tables.

20975 **(ABCC—08-62) ABCC-NIH adult health study, Hiroshima 1958-1960. Cardiovascular project report Number 6, heart size norm.** Ueda, Shoichi, Russell, W.J.; Yano, Katsuhiko. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). May 1962. Contract AC01-76EV03081. 22p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008155.

Utilizing the information obtained from the detailed clinical examinations of subjects seen at the Atomic Bomb Casualty Commission, standard heart size determinations in the Hiroshima population are provided. A formula has been devised to express the

normal transverse cardiac diameter, obtained from the routine posteroanterior chest roentgenogram, in relation to weight, height, and age. The analysis was made for each sex separately. Values computed by using this formula are regarded as standard heart size. Deviations from the standard are interpreted as individual variability in the normal group, with a standard deviation of 9 mm. When this standard was applied to abnormal subjects, a high correlation between the relative heart size and the blood pressure or the presence of overt heart disease was evident. For this reason, the relative heart size for this standard should prove useful, together with other related factors, in the diagnosis and investigation of cardiovascular disease. A nomograph has been devised for practical use. 12 references, 7 figures, 4 tables.

20976 **(ABCC—08-63) JNIH-ABCC life span study of children born to atomic bomb survivors. Report 1. Influence of concomitant variables upon mortality rate comparison.** Kato, Hiroo; Ueda, Shoichi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Apr 1963. Contract AC01-76EV03081. 33p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008454.

The study of mortality rates among children born to atomic bomb survivors is being conducted according to the protocol, and at present, data for those whose parents are included in the Life Span Study sample are ready for analysis. Using this portion, the influence of various concomitant factors on the infant mortality rate was investigated. The distribution of year of birth, maternal age, and birth order differs between comparison groups. The differences introduce fairly large biases into mortality rate comparisons. For example, the infant mortality rate in children, both of whose parents were atomic bomb survivors would be overestimated by 10% or more. As far as such concomitant factors are observable, the bias can be reduced to negligible magnitude. Other factors are equally important but difficult to observe. For example, environmental factors influence mortality a great deal but adequate methods for treating such factors have not yet been found. If such bias is not eliminated, conclusions to be derived from this study suffer serious limitation, namely, unless drastic radiation effects exist, neither existence nor absence of radiation effects will be demonstrable. Investigation is continuing, especially concerning: how to measure environmental factors; regression analysis on radiation dose or distance from the hypocenter; and examination of specific causes of death. 7 references, 4 figures, 9 tables.

20977 **(ABCC—08-64) Serum B_{12} levels in iron definiency anemia.** Sagan, L.A.; Ohki, Keiichi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 23 Apr 1964. Contract AC01-76EV03081. 9p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008441.

As part of its research program to study the late effects of radiation in survivors of the atomic bombs, the Atomic Bomb Casualty Commission (ABCC) in conjunction with the Japanese National Institute of Health (JNIH), conducts biennial medical examinations on the selected population which comprises the ABCC-JHIN Adult Health Study sample. The patients herein described as Groups 1 and 2 were selected from among those examined in Nagasaki who had had a hemoglobin value of less than 11.0 g/100 ml at examination 2 years previously and who had responded to iron therapy sufficiently to justify a diagnosis of iron deficiency anemia. Almost all were women of child bearing age. The effect of iron therapy on the level of serum B_{12} was investigated. Of 58 patients so studied, 46 showed some rise in post-treatment levels of B_{12}. This is evaluated as indicating that gastric secretion of intrinsic factor is depressed in the majority of iron deficient patients.

20978 **(ABCC—09-60) Adult Health Study: provisional research plan.** Hollingsworth, J.W.; Beebe, G.W. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Dec 1960. Contract AC01-76EV03081. 46p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008451.

The study is planned as an intensive search for the late effects of single, whole-body radiation from the Hiroshima and Nagasaki bombs. Although dosimetry information is by no means definitive at this time, preliminary information suggests that the effects of radiation doses up to 600 rads can be effectively studied in the surviving samples. The lower limit is moot, depending on the magnitude of the effect produced and the sensitivity of the study. The upper limit is also somewhat uncertain, as the most closely exposed individuals were more often heavily shielded. The potential radiation effects may be classified as follows: (1) alterations in the incidence of disease; (2) alterations in the natural history of disease, with or without alteration in incidence; (3) development of physiological or biochemical changes, or markers, short of actual disease; (4) nonspecific changes in vigor, acceleration of aging; and (5) occurrence of new diseases. It is proposed to conduct a search sufficiently intensive to detect effects of all five types. It is also a specific objective of this investigation to illuminate the pathogenesis of diseases of increased incidence, or of new diseases, if such be found. Also of interest is the matter of genetic or biochemical factors associated with survival and with the appearance of acute radiation symptoms. Survivors represent a truncated sample and selective host factors may have played a part in both survival and the liklihood of acute radiation symptoms. 17 reference.

20979 **(ABCC—09-63) ABCC-JNIH Adult Health Study, Hiroshima and Nagasaki, July-November 1962. Exposure to medical x-ray survey of subjects.** Russell, W.J.; Ishimaru, Toranosuke; Ihno, Yu. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Apr 1963. Contract AC01-76EV03081. 13p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008453.

A 4 month survey of ABCC-JNIH Adult Health Study subjects was conducted in the ABCC Department of Radiology, Hiroshima and Nagasaki, to determine the frequency and location of exposure to diagnostic irradiation in other hospitals and clinics, as well as occupational exposure. Background information and results of this survey are reported. 2 references, 1 figure, 7 tables.

20980 **(ABCC—10-59) Neoplasms among atomic bomb survivors in Hiroshima City. First report.** Harada, Tomin; Ishida, Morihiro. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Apr 1960. Contract AC01-76EV03081. 27p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008457.

The 1957-1958 incidence of neoplasms among the survivors of the Hiroshima A-bomb, varies directly with radiation dose insofar as it may be inferred from distance from the hypocenter at exposure. The incidence of all malignant neoplasms among the survivors who were within 1000 meters is more than 4 times that of the non-exposed population. The incidence of benign neoplasms among the survivors exposed within 1500 meters is also significantly higher than that among the non-exposed. For survivors under 1500 meters significant differences are seen between the numbers of observed cancers of the lung, stomach, uterus and ovary and the expected cases calculated from the age-specific rates of the non-exposed portion of the Hiroshima population. The increased incidence among survivors within 1500 meters is not related to sex or age. 18 references, 2 figures, 14 tables.

20981 **(ABCC—10-60) Adult health study reference papers. Selection of the sample. Characteristics of the sample.** Beebe, G.W.; Fujisawa, Hideo; Yamasaki, Mitsuru. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Dec 1960. Contract AC01-76EV03081. 66p. (In Japanese and English). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008425.

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The characteristics and selection of the clinical sample have been described in some detail to provide information on the comparability of the exposure groups with respect to factors excluded from the matching criteria and to provide basic descriptive information potentially relevant to individual studies that may be done within the framework of the Adult Health Study. The characteristics under review here are age, sex, many different aspects of residence, marital status, occupation and industry, details of location and shielding ATB, acute radiation signs and symptoms, and prior ABCC medical or pathology examinations. 5 references, 57 tables.

20982 **(ABCC—10-61) Methodology of morbidity studies: pilot survey of home visits.** Kato, Hiroo; Yoshitomi, Masakazu. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 28 Jun 1962. Contract AC01-76EV03081. 39p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008478.

The long term Adult Health Study conducted by Atomic Bomb Casualty Commission (ABCC) currently provides, on the basis of two-year cycles, regularly scheduled clinical examinations for exposed survivors and nonexposed control groups in Hiroshima and Nagasaki. Extensive field investigations of illness episodes now are being planned by ABCC. Two methods of obtaining this information may be considered: Directly from the Adult Health Study subjects by home visits; Indirectly from records of community medical institutions. The level of cooperation which might be expected from the subjects governs the feasibility of planning to obtain information directly by home visits. It is the purpose of this report to describe the pilot surveys designed and conducted primarily to provide this preliminary data concerning potential cooperation. Additional essential planning information provided by these pilot surveys concerned such problems as: Appropriate interval between home visits; Proper information where familes or groups are involved; Type and number of interviewers required; Effectiveness of daily health calendars; and Content of questionnaire. The previously mentioned alternative method of obtaining information from community medical records also is being evaluated in a similar investigation, for which a separate report will be published. 11 references, 2 figures, 27 tables.

20983 **(ABCC—10-63) Myelofibrosis with myeloid metaplasia, Hiroshima.** Anderson, R.E.; Hoshino, Takashi; Yamamoto, Tsutomu. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 May 1963. Contract AC01-76EV03081. 29p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008405.

The present study summarizes the clinical and autopsy findings in 12 patients with idiopathic generalized myelofibrosis with myeloid metaplasia autopsied over 10-year period at ABCC, Hiroshima. Ten of the patients were exposed to ionizing radiation at the time of the atomic bomb in 1945. The autopsy prevalence in these 10 exposed patients has been shown to be directly proportional to the distance from the hypocenter with the highest frequency among those survivors most proximally exposed. The autopsy prevalence of myelofibrosis among members of the exposed population was found to be 4-1/2 times greater than among the nonexposed autopsy population at ABCC and 18 times greater than the autopsy prevalence throughout the remainder of Japan. Although the present report strongly implicates ionizing radiation in the development of at least some cases of myelofibrosis, it does not exclude the possibility of other or even synergystic agents. No relationship was found between degree of exposure and time of onset of symptoms. Integration of the present data with the current concepts of myelofibrosis and the myeloproliferative disorders is discussed. 62 references, 3 figures, 4 tables.

20984 **(ABCC—10-64) Study of adolescents exposed in utero: clinical and laboratory data 1958-1959, Nagasaki. Report 2. Growth and development.** Burrow, G.N.; Hamilton, H.B.; Hrubec, Z.; Amamoto, Kichiro; Matsunaga, Fumie; Brill, A.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 23 Apr 1964. Contract AC01-76EV03081. 21p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008424.

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A group of 286 adolescent children, all of whom were in utero at the time of the atomic bombing in Nasasaki, were examined as part of a long-term program to determine possible differences in growth and development that might be attributable to exposure to ionizing radiation. Three comparison groups were studied: Group I, whose mothers were within 2000 m from the hypocenter; Group II, whose mothers were located between 3000 to 4999 m; Group III, whose mothers were not in the city at the time of the bomb. Group I was further subdivided into high and low dose categories as judged by direct dose estimates, whether or not the mother experienced the acute radiation syndrome, or whether she was more or less than 1500 m from the hypocenter. The age at menarche and degree of epiphyseal closure in the wrist were determined. In addition, measurements were made of head circumference, standing and sitting heights, weight, and chest circumference.

20985 **(ABCC—10-65) Human radiation effects: a report from the Atomic Bomb Casualty Commission.** Johnson, K.G.; Ciocco, A. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 9 Dec 1965. Contract AC01-76EV03081. 24p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008438.

This report has attempted to convey a general description of the ABCC populations under study and a summary of radiation-related findings. Attention has been particularly invited to the exposure-related findings of increases in leukemia, cataract, thyroid disease, microcephaly, and life shortening. The populations under study by ABCC are a valuable resource for the study of human disease. 38 references, 6 figures.

20986 **(ABCC—10-66) Mental retardation in children exposed in utero to the atomic bomb - Hiroshima and Nagasaki.** Wood, J.W.; Johnson, K.G.; Omori, Yoshiaki; Kawamoto, Sadahisa; Keehn, R.J. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 May 1966. Contract AC01-76EV03081. 17p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008406.

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Subjects who were exposed in utero to the atomic bombs in Hiroshima and Nagasaki, along with suitable controls, are examined annually at ABCC. Of the 1613 subjects in the study sample, 30 have gross mental retardation. Within 1500 m from the hypocenter the prevalence of mental retardation is 5 times as high as for the more distal subjects, and 6 to 15 weeks gestation was the most sensitive period. Even when subjects with possible explanations for their retardation are excluded the pattern of differences remains the same. All but two of the retarded subjects had a smaller than average head and for those who were within 1500 m this effect is accentuated. 17 references, 2 figures, 8 tables.

20987 **(ABCC—11-59) Leukemia in Nagasaki atomic bomb survivors.** Brill, A.B.; Heyssel, R.; Itoga, T.; Tomonaga, M. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Aug 1960. Contract AC01-76EV03081. 78p. (In Japanese and English). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008427.

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In the 13.5 years following the detonation of the atomic bomb, 95 cases of leukemia have been observed in the Nagasaki survivors. This increase is highly significant statistically. The increased leukemia risk apparently started 1.5 to 2.5 years following radiation exposure, and has lasted through 1958. Acute leukemias of all types and chronic granulocytic leukemia are increased, (with the possible exception of the Schilling type of acute monocytic leukemia). Males in general, and individuals in the younger ages (0 to 09), are apparently most sensitive. The risk of radiation induction of leukemia is related to the size of the dose. The shape of the curve does not differ greatly from a linear model, but is consistent with a variety of hypotheses. The data in the low dose region are too limited to be of significance in evaluating the risk of low doses of radiation. The data suggest that high radiation doses may be associated with a decrease in the latent period to leukemia induction. 43 references, 2 figures, 31 tables.

20988 **(ABCC—11-60) ABCC-NIH Adult Health Study, Hiroshima, 1959: achlorhydria.** Knittle, J.L. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Jul 1960. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008444.

In Hiroshima Adult Health Study 1251 subjects were examined for achlorhydria and the proportion with achlorhydria was analyzed as to age, sex, blood type, and exposure to radiation. Achlorhydria was found to be more prevalent in subjects aged 40 and over,than in similar United States populations, and blood Type A subjects were found more achlorhydric than Type O subjects at ages 30 to 49. No differences were found between exposed and

nonexposed, nor between those exposed at greater and lesser distances from the hypocenter. The data suggest that achlorhydria may be related to the high incidence of gastric cancer in Japan and seem consistent with the hypothesis that achlorhydria occurs prior to gastric cancer and may be related to inherited factors. 26 references, 4 tables.

20989 **(ABCC—11-61) Adult health study. Hiroshima preliminary report, 1958-1959.** Hollingsworth, J.W.; Anderson, P.S. Jr. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 28 Jun 1961. Contract AC01-76EV03081. 99p. (In Japanese and English). NTIS, PC A05/MF A01; GPO Dep. Order Number DE84008443.

The first 4151 clinical examinations of radiation exposed and nonexposed persons in the Hiroshima Adult Health Study have been tabulated and reviewed. No evident differences in past history, medical symptoms, physical examination, laboratory findings, nor disease incidence could be related to the atomic radiation in 1945. The sample is small and represents only a portion of the first cycle of an examination procedure that is planned to continue indefinitely at approximately two year intervals. This report, consisting of a review of the program and the findings in this preliminary sample, includes extensive tabular data (Tables 28-65) from the coded medical information. It was not expected that radiation induced changes would be evident from this sample unless they were of unexpected prominence. The report was prepared primarily to describe the problems inherent in an epidemiologic medical study of this sort, and to review the type of data that can be obtained for future analyses. This analysis was conducted to pinpoint some of the problems; to assist others contemplating this type of medical study; to illuminate for ABCC the data that are being collected; and to suggest ways to use these data most effectively. 16 references, 1 figure, 65 tables.

20990 **(ABCC—11-62) Research plan for joint ABCC-NIH adult health study in Hiroshima and Nagasaki.** (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 27 Jul 1962. Contract AC01-76EV03081. 59p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008407.

A summary of the research plan is presented. The study is planned as an intensive search for the late effects of single, whole-body radiation from the Hiroshima and Nagasaki bombs. Although dosimetry information is by no means definitive at this time, preliminary information suggests that the effects of radiation doses up to 600 rad can be effectively studied in the surviving samples. The lower limit is moot, depending on the magnitude of the effect produced and the sensitivity of the study. The upper limit is also somewhat uncertain, as the most closely exposed individuals were more often heavily shielded. The ABCC program of collecting shielding histories is not yet complete, and doubt may be expressed as to the heights of the air-dose curves currently employed in calculating individual dose. It is also a specific objective of this investigation to illuminate the pathogenesis of diseases which may be found to be related to radiation if such be found. Work of this nature would, of course, lead to the development of specific protocols for the investigation of these problems. Also of interest is the matter of genetic or biochemical factors associated with survival and with the appearance of acute radiation symptoms. Survivors represent a truncated sample and selective host factors may have played a part in both survival and the likelihood of acute radiation symptoms. Specific investigations in this area are worthy of pursuit, but it seems appropriate here to delineate this area as part of the broad purpose motivating the present research. 19 references, 1 table.

20991 **(ABCC—11-63) ABCC-JNIH Adult Health Study, Hiroshima and Nagasaki 1962-1963. Exposure to medical x-ray community hospital and clinic survey.** Ihno, Yu; Russell, W.J.; Ishimaru, Toranosuke. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 May 1963. Contract AC01-76EV03081. 22p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008420.

A survey was conducted in Hiroshima and Nagasaki hospitals and clinics at which Adult Health Study subjects received medical x-ray exposure, and analysis of data is presented. The prime interests of this survey were to ascertain the factors of exposure, in as great detail as possible, and to obtain some basic information preparatory to designing a dosimetry study. The technical factors employed in chest examinations by hospitals and clinics are discussed. 3 references, 7 figures, 5 tables.

20992 **(ABCC—11-66) Growth and development of children exposed in utero to the atomic bombs in Hiroshima and Nagasaki.** Wood, J.W.; Keehn, R.J.; Kawamoto, Sadahisa; Johnson, K.G. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 6 Jun 1966. Contract AC01-76EV03081. 23p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008408.

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Subjects who were exposed in utero to the atomic bombs in Hiroshima and Nagasaki, along with suitable controls, are examined annually at ABCC. At age 17 years, 1259 of the 1613 subjects in the study sample were examined and a tendency was observed for the proximal exposed to be least advanced in growth. The major effects are found most frequently in those who had been within 1500 m from the hypocenter of the bomb and include decreased head circumference, height, and weight. The levels of these effects do not vary by trimester of gestation. 15 references, 1 figure, 13 tables.

20993 **(ABCC—12-60) Serum pepsin levels Hiroshima adult health study. Relation to radiation, ABO blood groups, and gastrointestinal diseases.** Knittle, J.L. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Jul 1961. Contract AC01-76EV03081. 19p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008409.

At the ABCC clinic in Hiroshima 1330 subjects were investigated as to serum pepsin levels over a four month period. The normal mean values compared well with those reported for a United States population using a similar technique. There appeared to be no significant change in serum pepsin level with age, and no difference could be detected among individuals of the ABO blood groups. No relationship was found between serum pepsin level and exposure to ionizing radiation. Patients with gastric and duodenal ulcers had mean levels which were higher than normal mean values, while patients with leukemia had lower than normal mean levels. Patients with gastric polyps and gastric cancer had normal mean values. It is believed that the relation of serum pepsin activity to cancer of the stomach is not settled and deserves further investigation. 23 references, 2 figures, 4 tables.

20994 **(ABCC—12-61) Ophthalmology programs at ABCC. A brief review and preliminary plan.** Finch, S.C.; Jablon, S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Jul 1961. Contract AC01-76EV03081. 30p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008419.

A proposal is made for a continuing ophthalmology program for exposed and control subjects at Nagasaki and Hiroshima. This program is based on a fixed population selected from the PE-86 and the ME-200 Adult Health Study samples. 27 references, 4 tables.

20995 **(ABCC—12-62) Research plan for joint ABCC-NIH pathology studies in Hiroshima and Nagasaki.** (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 27 Jul 1962. Contract AC01-76EV03081. 80p. (In Japanese and English). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008410.

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A program for the conduct of pathology studies within fixed cohorts of Hiroshima and Nagasaki A-bomb survivors is described. It is intended that the program serve as a basis for collaborative efforts by community medical institutions and organizations together with ABCC-NIH in both cities. The report describes the scope of the program, together with epidemiologic aspects of the population base and methods of case procurement, and outlines proposed studies. Detailed descriptions of autopsy protocols, surgical pathology reports, coding procedures, and other procedural and operating matters will be considered in a subsequent report. 37 references, 4 figures, 8 tables.

20996 **(ABCC—12-63) ABCC-JNIH Adult Health Study. Report 2. 1958-1960 cycle of examinations Nagasaki.** Sagan, L.; Seigel, D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 29 Oct 1963. Contract AC01-76EV03081. 73p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008418.

This report has presented the basic data collected during the 1958 to 1960 cycle of examinations in the ABCC-JNIH Adult Health Study in Nagasaki. No large differences were found among the 4 comparison groups. The only exceptions are to be found in a number of nonspecific complaints elicited during the review of systems. Inevitably in a review of this size some differences appeared between groups. These are pointed out in the text whenever possible. None were so large, nor so consistent within specific age and sex groups, however, that they could be categorically attributed to radiation. It will be necessary to compare them with subsequent medical experience in this study group and in Hiroshima. 13 references, 41 tables.

20997 **(ABCC—13-59) Delayed radiation effects at Hiroshima and Nagasaki.** Bugher, J.C. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1 Mar 1963. Contract AC01-76EV03081. 13p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008430.

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This report describes the early efforts to get a research group together to study the long-term effects of the atomic explosions on the survivors in Hiroshima and Nagasaki. The programs assigned to this research group (Atomic Bomb Casualty Commission-ABCC) are described as well as the research in progress during 1959. Post-treaty relationships are discussed. (DMC)

20998 **(ABCC—13-61) Adult health study Hiroshima analysis of participation in examinations, July 1958-December 1960.** Anderson, P.S. Jr. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Jul 1961. Contract AC01-76EV03081. 25p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008411.

The participation data for Adult Health Study examinations conducted in Hiroshima during the period July 1958 to December 31, 1960, are presented. The continuing medical examination program includes approximately 13,700 individuals who form the Adult Health Study population of ABCC in Hiroshima. The Adult Health Study population is composed of four exposure groups of equal size, matched by age and sex. Participation scores are analyzed with respect to exposure, age, sex, and socioeconomic variables as well as history of previous contact with the ABCC programs. Significant differences were demonstrated between the participation scores by age, marital status, history of prior contact with ABCC, and occupation; this latter category was significant only for males. Although differences were observed for these variables, the significance was usually attributable to one category in each of the variables, often the least populated, such as separated or divorced for marital status; and previous history unknown for prior ABCC contact. A trend was apparent with respect to exposure, with the lowest participation noted in the nonexposed and the highest participation in the exposed group with symptoms. Sex differences were not significant. Although relatively minor differences were demonstrated for some variables, the outstanding features of this program are the remarkable high participation scores. Only 9 percent of the population were in the so-called refusal category and over 80 percent of the living Adult Health Study population, including non-Hiroshima residents, were examined during the period considered by this report. 6 references, 1 figure, 9 tables.

20999 **(ABCC—13-62) ABCC-NIH Adult Health Study, Hiroshima and Nagasaki 1958-61. Thyroid carcinoma.** Socolow, E.L.; Neriishi, Shotaro; Niitani, Ryuzo; Hashizume, Asaji. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 11 Jul 1962. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008432.

This study reviews carcinoma of the thyroid detected during a three year period in the Adult Health Study populations of Hiroshima and Nagasaki. The investigation was undertaken to determine whether or not a relationship exists between previous exposure to ionizing radiation and the subsequent development of thyroid malignancy. All cases were found during routine medical examinations for matched groups of exposed and nonexposed subjects cooperating in the long term medical investigations of Atomic Bomb Casualty Commission (ABCC). 9 references, 1 figure, 7 tables.

21000 **(ABCC—13-63) ABCC-JNIH adult health study 1958-1960, Hiroshima: review of tubercolosis.** Turner, R.W.; Hollingsworth, D.R. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 May 1963. Contract AC01-76EV03081. 24p. (In Janapese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008412.

The present study was undertaken in Hiroshima to determine the prevalence of tuberculosis among the Adult Health Study comparison groups and to attempt to determine whether a radio-sensitive factor could be inferred in resistance to development of clinical tuberculosis. In addition, the data provided an epidemiologic view of tuberculosis in a modern, urban, industrialized Japanese community. 31 references, 7 tables.

21001 **(ABCC—13-64) Ophthalmology research protocol, Hiroshima - Nagasaki.** Miller, R.J.; Fujino, Tadashi; Nefzger, M.D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 21 May 1964. Contract AC01-76EV03081. 36p. (In Janapese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008426.

Several large ophthalmic studies have been made at ABCC. However, all preceded the final identification and definition of the Master Sample which unifies the three present major research studies, and T57D estimates were not available. For these reasons it seemed highly desirable to undertake another ophthalmic study which would both relate to the present program and utilize available dose information. Consequently, in 1962 a consultant in ophthalmology, Dr. P.J. Leinfelder visited ABCC to acquaint himself with the ABCC program and facilities, and he prepared the broad plan for this study. The present document describes the detailed working program which developed from this initial plan. For the period 1963 to 1964, investigation will be directed towards detection and evaluation of the following possible late effects of exposure to ionizing radiation: lens opacities; accelerated aging; and decreased acuity. 43 references, 1 figure, 4 tables.

21002 **(ABCC—14-59) Radiation dosimetry in Hiroshima and Nagasaki atomic bomb survivors.** Arakawa, E.T. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 21p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008439.

This report summarizes the present state of knowledge in dosimetry of the Hiroshima-Nagasaki A-bomb survivors. Data have been presented on the physical factors involved in the two cities and on attenuation of radiation by various shielding situations. This information is being used to estimate a tentative radiation dose to individual A-bomb survivors. It should be emphasized that many important problems remain to be solved before accurate doses can be assigned to individual survivors. Such information will greatly strengthen investigation of biological consequences of instantaneous doses of gamma and neutron irradiation in men. 18 references, 9 figures.

21003 **(ABCC—14-60) Blood bactericidal activity in Hiroshima subjects.** Hollingsworth, J.W.; Hamilton, H.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 7 Mar 1961. Contract AC01-76EV03081. 20p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008413.

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A simple screening method for blood bactericidal activity was developed for study of irradiated atomic bomb survivors and nonirradiated subjects in Hiroshima. Blood bactericidal activity was found to be a relatively constant biological phenomenon in all subjects studied. No differences in activity were detected in relationship to radiation exposure in 1945. 17 references, 6 tables.

21004 **(ABCC—14-62) JNIH-ABCC Life Span Study, Hiroshima 1950-59. Multiple causes of death stated in medical certificates.** Ishida, Morihiro; Jablon, S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 22 Aug 1962. Contract AC01-76EV03081. 33p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008414.

The applicability to the JNIH-ABCC Life Span Study of secondary causes shown in Hiroshima death certificates is discussed. The analysis is based on 5526 death certificates reported among members of Selection I and II of the Life Span Study sample. Secondary causes appear to be of only limited usefulness to the Life Span Study. Factors such as age, sex, exposure status, which may influence the frequency of entry of secondary causes in medical certificates are analyzed. Age is the only factor which shows a significant relationship and this may be interpreted as resulting from the fact that chronic diseases with multiple illnesses are most prevalent among persons at older ages. The number of secondary causes in the present study is too small to delineate in detail the pattern of complications or contributory causes. However, 9 cases of malignant neoplasms were entered only as complications and were missed in the primary tabulation, representing only about one percent of all malignancies. Secondary causes shown in the death certificates and associated causes found at postmortem examination seem not to be comparably distributed, thus raising a serious problem as to the applicability of the former to the Life Span Study. Both the magnitude and accuracy of entry of the secondary causes are influenced greatly by the ease with which illnesses may be detected clinically. 9 references, 12 tables.

21005 **(ABCC—14-64) Background and status of clinical study is determine effects of in utero exposure Hiroshima and Nagasaki.** Burrow, G.N.; Hrubec, Zdenek, Finch, S.C. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 2 Jul 1964. Contract AC01-76EV03081. 33p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008415.

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The mortality experience of a cohort of approximately 100,000 persons selected from survivors of the Hiroshima and Nagasaki atomic bombings and a comparison of persons who were not in the cities at the time of bombing (ATB) was studied for the period 1 October 1950-30 September 1959.

21006 **(ABCC—15-59) Leukemia in humans following exposure to ionizing radiation. A summary of the findings in Hiroshima and Nagasaki and comparison with other human experience.** Brill, A.B.; Tomonaga, Masanobu; Heyssel, R.M. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Oct 1960. Contract AC01-76EV03081. 40p. (In Janapese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008447.

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A review of the Hiroshima-Nagasaki leukemia experience thirteen years after the atomic bomb explosion in those two cities, and comparisons with other collected series of leukemia cases following radiation has again demonstrated beyond reasonable doubt the leukemogenic effect of ionizing radiation on humans. In spite of the heterogeneity of the various study groups there are surprisingly consistent findings. An increased risk of leukemia following doses probably as low as 50 to 100 rads (air-entry dose) whole body radiation has been demonstrated. Above this dose the increase in incidence of leukemia may be related linearly to dose of radiation. When extrapolated to zero dose this line intersects the expected spontaneous incidence. In the lower range it is impossible to be certain regarding the presence or absence of a threshold. As in other series the acute lymphocytic variety of leukemia in the very young is most increased. Chronic granulocytic leukemia was seen most commonly among the Japanese in the older age groups. The predilection of the various types of leukemia for specific age groups does not appear to be markedly altered although possibly the incidence of chronic granulocytic leukemia has been shifted to younger ages. Males and children in the age group below ten appear to be most sensitive to induction of leukemia by irradiation. The increased occurrenc of leukemia in an irradiated population appears to start about eighteen months after the event. In Japan the increased risk has persisted for thirteen years with the time of maximum risk approximately four to eight years following radiation. 128 references, 2 figures, 14 tables.

21007 **(ABCC—15-61) Tuberculosis and A-bomb exposure. A study of Nagasaki Mitsubishi shipyard workers.** Komatsu, Teizo; Onishi, Shigeyuki. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1961. Contract AC01-76EV03081. 23p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008416.

The purpose of this study is to determine whether or not there are differences in the prevalence, or in the type and severity of tuberculosis seen in exposed and nonexposed subjects. 8 references, 1 figure, 12 tables.

21008 **(ABCC—15-62) Epidemiologic evaluation ABCC and Nagasaki University School of Medicine autopsies and ABCC surgical specimens: Nagasaki 1950-59.** Samther, T.G.; Hrubec, Zdenek; Brown, W.J.; Thomas, G.D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 22 Aug 1962. Contract AC01-76EV03081. 47p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008446.

This epidemiologic evaluation covered autopsies performed at ABCC Nagasaki and at the Nagasaki University School of Medicine, as well as surgical pathology specimens examined at ABCC Nagasaki during 1950-59. The material was related to the ABCC Master Sample population. Bias was demonstrated with respect to symptom status, exposure, age, death certificate diagnosis, male occupations, and history of previous medical examinations at ABCC. In addition the ABCC autopsy series was found to be biased with regard to sex. Comparison with data from Hiroshima indicated similar bias which is possibly more pronounced in Hiroshima. On the basis of these findings, it was concluded that at this time the material is not suitable for broad epidemiologic studies of clinically manifest disease. The material, however, does lend itself to a number of studies of clinically occult disease and other problems which were discussed. 19 references, 32 tables.

21009 **(ABCC—15-64) Autopsy study of leukemia in Hiroshima.** Anderson, R.E.; Yamamoto, Tsutomu; Yamada, Atsushi; Will, D.W. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Jun 1964. Contract AC01-76EV03081. 18p. (In Japanese and English). NTIS, PC A02/MF A01. Order Number DE84008442.

The present study concerns 157 cases of leukemia autopsied at ABCC Hiroshima during 1949-1962. The epidemiologic characteristics of the survivor and immigrant populations are discussed with special reference to leukemia and to the comparability of the various exposure groups. A comparison between leukemia cases in the groups within 1400 m and beyond 1400 m showed the following: (1) cases within 1400 m with acute and chronic myelogenous leukemia had a shorter clinical survival after the onset of symptoms ascribable to leukemia; (2) this same group of cases had much smaller spleens than those beyond 1400 m; and (3) diffuse bone marrow fibrosis was increased in cases of chronic myelogenous leukemia within 1400 m and, when compared to leukemic individuals without this finding, was associated with a longer clinical course. The possible interpretations of these findings are discussed. No others morphologic differences were found between leukemia cases in the group within 1400 m and the groups beyond 1400 m or not in the city ATB and it was not possible to identify an individual case as radiation-induced. 32 references, 2 figures, 2 tables.

21010 **(ABCC—16-60) Study of adolescents exposed in utero: research plan.** Burrow, G.N.; Hrubec, Z.; Hamilton, H.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 27 Jan 1961. Contract AC01-76EV03081. 43p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008437.

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The Study of Adolescents Exposed In Utero is an investigation of possible clinical and biochemical differences in growth and development during puberty that may be attributed to irradiation from the atomic bomb. Since 1951 there has been a continuing climical study of a group of children who were in utero at the time of

the atomic bombing. The current work is designated as the PE-86 program, and adolescents exposed in utero are a study sample within it. The children in the adolescent subsample are being examined more frequently than those in the larger PE-86 Study. Particular emphasis is being placed on the secondary sexual characteristics. In addition, arrangements have been made to collect twenty-four hour urine samples and perform various endocrine determinations. It is hoped that by frequent physical examinations and urinary hormone determinations, it will be possible to follow the pubertal growth spurt fairly closely. 30 references, 2 figures, 8 tables.

21011 **(ABCC—16-61) Clinical survey to detect diabetes mellitus, Hiroshima.** Rudnick, P.A.; Anderson, P.S. Jr. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Jul 1961. Contract AC01-76EV03081. 36p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008159.

Data from this study are in agreement with the general observations that diabetes is not uncommon in Japan. In an adult study population in Hiroshima 108 patients with diabetes were detected, yielding the prevalence rate of 3.02 percent. Nearly one-half of the patients were diagnosed initially as a result of the routine detection program. Although in females a trend with exposure is suggested by the raw data no statistically significant differences could be demonstrated. However, the size of the sample involved does not permit confident negative conclusions. Additional clinical and laboratory observations were completed in order to characterize the manifestation of diabetes in these subjects. Late manifestations of diabetes frequently were found, but atherosclerotic complications were nonexistent. This is considered to be related to the low fat, high carbohydrate diet of the Japanese. The lack of ketosis, apparently low prevalence rate for juveniles, and male preponderance suggest that diabetes in Japan differs from the disease found in many Western countries. 69 references, 1 figure, 9 tables.

21012 **(ABCC—16-63) Carcinogenesis in Hiroshima and Nagasaki. Observations from ABCC-JNIH pathology and statistical studies.** Zeldis, L.J.; Jablon, S.; Ishida, Morihiro. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1963. Contract AC01-76EV03081. 20p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008097.

Studies in Hiroshima and Nagasaki of a possible carcinogenic effect of radiation in survivors of the atomic bombings are included in programs conducted jointly by the Atomic Bomb Casualty Commission (ABCC) and the Japanese National Institute of Health (JNIH) with the collaboration of physicians and medical organizations in both cities. In order to cope with epidemiologic problems that attend these, in common with other studies of human populations. ABCC-JNIH programs are now oriented to the intensive surveillance of health, morbidity, and mortality principally in known, fixed cohorts of the survivors. The data reported here are derived from 3 interrelated programs in Hiroshima and Nagasaki: the JNIH-ABCC Life Span Study, Tumor Registry Studies, and Joint ABCC-JNIH Pathology Studies. The population samples utilized in these studies are defined along with summarizing pertinent information concerning their exposure to ionizing radiation. 11 references, 2 figures, 10 tables.

21013 **(ABCC—16-65) Epidemiologic study of uterine cancer, Hiroshima.** Ishimaru, Toranosuke. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 10 Dec 1965. Contract AC01-76EV03081. 13p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008121.

As a cause of death in females, cancer of the uterus is one of the important cancers in Japan. In 1962 it was responsible for 15.5% of all the deaths due to cancer in women and ranked next to the proportion attributed to cancer of the stomach. The JNIH-ABCC Life Span Study of A-bomb survivors also shows that cancer of the stomach and uterus were the major causes of cancer deaths in the female population. The present study, which was carried out in 1963, was begun in the hope of elucidating some of the relationships of the factors other than radiation possibly associated with the incidence of cancer of the uterus in the Life Span Study (ST 100) sample in Horoshima. Environmental factors considered to play a role in the development of uterine cancer were studied by interview with a close relative of the subject. The data did not clearly support the findings reported elsewhere that residential history, occupational history, history of marital status, smoking and alcohol drinking habits, and socioeconomic factors were associated with the incidence of cancer of the uterus. A brief analysis was also conducted for the accuracy of death certificates. The results suggest that an epidemiologic study should be conducted on morbidity data derived from pathologic findings and a revised plan is desirable to elucidate the factors associated with the incidence of cancer of the uterus using the various recent experimental findings as references. 124 references, 15 tables.

21014 **(ABCC—17-59) Original signs and symptoms in patients surviving five years after atomic bomb exposure under 1000 meters.** Lewis, J.J.; Patterson, H.A. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 22p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008092.

Atomic bomb victims in Hiroshima who were exposed under 1000 meters and survived over five years were reinvestigated. There were 619 patients who comprised a total sample. Mechanical, blast, burn and radiation injuries were evaluated as to onset, duration, severity, body area affected and type of healing. The modal patient experienced severe radiation and mild trauma. Results were compared with similar earlier studies. The question emerges as to the possibility that patients exposed within 1000 meters with radiation and/or thermal injuries have been dying at a faster rate than those with mechanical or no injuries. A short history of the development of the Atomic Bomb Casualty Commission is included. 17 references, 11 tables.

21015 **(ABCC—17-61) Background and status of clinical study to determine effects of in utero exposure Hiroshima and Nagasaki.** Burrow, G.N.; Hrubec, Zdenek, Finch, S.C. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 13 Aug 1962. Contract AC01-76EV03081. 32p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008477.

Programs underway in Hiroshima and Nagasaki to study the effects of prenatal exposure are summarized. Methods for sampling, analysis, and surveillance are described. 24 references, 4 tables. (DMC)

21016 **(ABCC—17-62) Study of adolescents exposed in utero. Methodological evaluation of the Nagasaki sample.** Hrubec, Zdenek, Noble, K.B.; Burrow, G.N. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Sep 1962. Contract AC01-76EV03081. 62p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008161.

Fetal tissues have been shown to be extremely sensitive to ionizing radiation, and therefore a group of children who were exposed in utero are of special interest. When these children entered adolescence, an intensive study was undertaken to determine whether differences not otherwise apparent would be revealed during the stress of this period of rapid growth. The purpose of this report is to describe the sample used to study these adolescent children who were exposed in utero and to provide reference information. The problems of using ex post facto methods as employed in this study have been discussed in detail elsewhere. In summary, the extent to which findings of a retrospective study may be generalized to a larger population can be determined only from a careful and extensive study of the characteristics of the sample and an evaluation of the procedures used in its selection. It is generally recognized that even an extensive methodologic exploration of this kind offers no conclusive proof that a sample is useful for a specific study. In the sample, some variables which may have a considerable effect on the medical data, such as socioeconomic status, have been taken into account only superficially. There is always the possibility that some important, completely unsuspected variables may produce spurious associations. However there is an almost infinite number of such factors which might conceivably affect the data. Vast research resources could be committed to a methodologic

evaluation without fulfilling the basic purpose of the study. An approach must be devised which is judged methodologically adequate but which will not tax the research resource to the detriment of the basic objectives. It is hoped that this report will satisfy the requirements of this compromise. 30 references, 36 tables.

21017 **(ABCC—17-63) ABCC-JNIH Adult Health Study, Hiroshima and Nagasaki, November 1961-June 1962: peripheral osteoporosis.** Blackard, W.G.; Seigel, D.G. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 11 Jul 1963. Contract AC01-76EV03081. 15p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008153.

The prevalence of peripheral osteoporosis was assessed in a portion of the ABCC-JNIH Adult Health Study group in Hiroshima and Nagasaki, Japan. As in the west, osteoporosis is seen most commonly in post-menopausal women occurring in 32.6% of females over age 60. Dietary calcium was only slightly lower in osteoporotic compared to nonosteoporotic subjects. This difference was not statistically significant. Ionizing radiation from the atomic bombs in 1945 had no apparent influence on the prevalence of peripheral osteoporosis. Osteoporotic women weighed less than nonosteoporotic women. 13 references, 2 figures, 4 tables.

21018 **(ABCC—17-64) Aging in Hiroshima atomic bomb survivors.** Anderson, R.E. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Jun 1964. Contract AC01-76EV03081. 12p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008388.

This report concerns the hexosamine:collagen ratio in skin and aorta obtained from men autopsied at ABCC hiroshima during 1962 to 1964. The study includes 14 proximally exposed individuals paired by age with an equal number of individuals who were not in Hiroshima at the time of the atomic explosion. In a statistically significant number of the pairs (11), tissue from the exposed member was found to have a smaller hexosamine:collagen ratio than the nonexposed member; this suggests the presence of accelerated aging among proximally exposed persons. However, other possible explanations for the experimental observations are offered; in view of these and until a broader knowledge of aging is available, the results of the present study should be interpreted with caution.

21019 **(ABCC—17-65) Distribution, incidence, and appearance time of radiation-related leukemia in Hiroshima and Nagasaki, 1946 to 1964.** Bizzozero, O.J., Jr.; Johnson, K.G.; Ciocco, A.; Hoshino, Takashi; Itoga, Takashi; Toyoda, Shigeki; Kawasaki, Sho. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 4 Jan 1966. Contract AC01-76EV03081. 27p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008132.

The observations of the occurrence of leukemia in Hiroshima and Nagasaki for the period 1946 to 1964 are presented. Leukemia developed excessively in those persons exposed at 0 to 1500m from the hypocenter during this period. A decreased appearance time, defined as the interval between exposure to radiation and the clinical or symptomatic onset of leukemia, was noted in those cases exposed at 0 to 1500m. Attention is invited to the role of age as a covariable to distance in the appearance time of acute leukemia developing in those persons exposed at 0 to 1500m. In the 0 to 1500m group, persons 0 to 29 years of age at the time of the bombs developed chronic granulocytic leukemia during 1946 to 1955 at a disproportionate rate compared to the distally exposed and differ from the overall pattern of spontaneous leukemia for this age group.

21020 **(ABCC—18-59) Brachyphalangism and brachymetapodia of the hand. A radiological study.** Pryde, A.W.; Kitabatake, Takashi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Oct 1960. Contract AC01-76EV03081. 17p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008087.

Left hand roentgenograms were studied of Japanese children of Hiroshima divided into three groups; Group I was 1302 male and 1237 female normal, healthy controls; Group II was 219 children exposed to the atomic bomb on August 6, 1945 while still intra-utero; Group III was 174 non-exposed control children who were intra-utero on August 6, 1945. Brachymesophalangism of the left little finger was found in the control children in 14.13 percent of males and 21.26 percent of females when epiphyseal irregularity as well as actual shortening is considered as a criterion. Incidence of brachymesophalangism of the left little finger was not significantly different for children exposed to the atomic bomb while intra-utero. Bone age of children with brachymesophalangism and those exposed to the atomic bomb while intra-utero showed no difference from the normal. Brachytelephalangism of the thumb occurs in 2.1 percent of normal boys and in 2.9 percent of normal girls. A possible relation between brachymesophalangism of the little finger and brachytelephalangism of the thumb occurring in the same child is suggested by an association significant at the 5 percent level. Brachymetapodia occurred in 0.2 percent of normal boys and 0.6 percent in girls and was seen most often in the fifth metacarpal. 21 references, 6 tables.

21021 **(ABCC—18-60) Medical findings and methodology of studies, Hiroshima and Nagasaki, 1958.** Hollingsworth, J.W.; Beebe, G.W.; Ishida, Morihiro; Brill, A.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Sep 1960. Contract AC01-76EV03081. 67p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008135.

A description of the population studied and the program of the Atomic Bomb Casualty Commission to study the late effects of radiation are presented. These include investigations of radiation dose, life span, medical surveys, tumor registries, autopsy program, leukemia survey, morbidity detection, in utero studies, genetic effects, effects on the growth and development of children, radiation cataracts, neoplasia, and fertility. 61 references, 18 figures, 5 tables. (DMC)

21022 **(ABCC—18-61) Illness episodes among employees of Hiroshima railway division pilot study. I. Morbidity. II. Absenteeism.** Kato, Hiroo; Yoshitomi, Masakazu. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 23 Aug 1961. Contract AC01-76EV03081. 32p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008475.

As a part of the study of delayed effects which occur in man as a result of exposure to the atomic bomb, the Atomic Bomb Casualty Commission (ABCC) presently is designing a field study to obtain information on illness episodes in the members of the Adult Health Study. As a preliminary, it is desirable to investigate with great care various problems concerning the methods of study. The present report is concerned with the procedure of securing information from the records of medical institutions. The Hiroshima Railway Hospital and ABCC have conducted a morbidity study on railway workers in the jurisdiction of the Hiroshima Railway Division not only for the sake of the information that might be obtained but also as a guide for future studies of this type. The social environment of workers of Hiroshima Railway Division is comparatively uniform; they are under a complete medical care system; and data are readily available when a doctor's treatment is received. Thus, these workers are particularly suitable for study of the number of illnesses requiring treatment by physicians, the factors affecting this number, and the relation between amount of illness and exposure status. 8 references, 1 figure, 17 tables.

21023 **(ABCC—18-63) Month of estimated onset of leukemia in Hiroshima and Nagasaki atomic bomb survivors.** Nefzger, M.D.; Hoshino, Takashi; Itoga, Takashi; Yamada, Atsushi; Toyoda, Shigeki. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 3 Oct 1963. Contract AC01-76EV03081. 14p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008134.

The monthly distribution of onset of leukemia during 1946-61 has been examined in 638 known cases among Hiroshima and Nagasaki atomic bomb survivors. Comparisons were made of sex, city, chronicity, and distance from the hypocenter. A summer excess was most prominent in the group 0-1999 m from the hypocenter, and an autumn deficiency was most consistently seen in the various subgroups. No explanation of these differences can be offered. 1 reference, 2 figures, 3 tables.

21024 **(ABCC—18-64) Epidemiology of diabetes mellitus in Hiroshima and Nagasaki.** Freedman, L.R.; Blackard, W.G.; Sagan, L.A.; Ishida, Morihiro; Hamilton, H.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 10 Jun 1965. Contract AC01-76EV03081. 23p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008392.

Data have been presented on the finding of glycosuria and the diagnosis of diabetes mellitus during four years of a long-term study of the health of population samples of Hiroshima and Nagasaki. Diabetes and glycosuria are much more common in Hiroshima than in Nagasaki and in both cities these findings are more frequent in males than in females. The prevalence of diabetes appears to be increasing in Hiroshima males. Findings in diabetics were compared with nondiabetics. In general, Japanese diabetics are similar to diabetics in other countries concerning their increased risk of obesity, hypertension, proteinuria, hypercholesterolemia, and cardiovascular and cerebrovascular diagnoses. This is of particular interest in the light of evidence that ketosis and severe abnormalities of carbohydrate metabolism are rare in Japan as compared to Western countries. Despite a lower prevalance of diabetes in Japanese females than in males, the abnormalities associated with diabetes appear to occur more commonly in female diabetics than in male diabetics.

21025 **(ABCC—18-65) Mortality 1950-1964 and disease and survivorship 1958-1964 among sample members aged 50 years or older, October 1, 1950.** Ciocco, A. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1965. Contract AC01-76EV03081. 54p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008119.

Persons who were 50 years or older in 1950, or 45 years or older at the time of the atomic bomb (ATB), constitute that portion of the Life Span Study sample subject to the highest disability and mortality risks, from malignancies as well as from other chronic disease conditions. Furthermore, this age class is rapidly approaching the modal age of death. Hence, whatever late effects of exposure to the bomb in 1945 are to occur they should be perceptible by this time. With this view in mind, mortality, and the occurrence of selected diseases subsequent to 1950 have been compared for the following purposes among designated exposure groups: to specify the size and trend of differences among the exposure groups; and to point up some of the issues which must be met in planning future statistical-epidemiologic studies at ABCC. The three exposure groups compared were: persons within 1400 m from the hypocenter (0 to 1399 m); those beyond 1400 m (1400 to 9999 m); and persons not in the city ATB. Each group has been examined for: cumulative mortality pattern from 1 October 1950 to 30 September 1964, for all causes of death, for deaths from tuberculosis, lung cancer, stomach cancer, and leukemia; occupation characteristics and their relation to mortality; selective factors related to inclusion in the ABCC-JNIH Adult Health Study, and prevalance and incidence of, and survivorship from, tuberculosis among participants in the Adult Health Study, 1958 to 1964; and selective factors related to frequency of autopsy, 1961 to 1964. 11 references, 2 figures, 22 tables.

21026 **(ABCC—19-60) Comparison of death certificate and autopsy diagnoses - Hiroshima.** Stone, R.S.; Anderson, P.S. Jr. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Sep 1960. Contract AC01-76EV03081. 45p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008393.

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In this report evaluation of the death certificates has been on the basis of comparison with recorded autopsy diagnoses without review of the latter. An attempt has been made to evaluate limitations inherent in this method. The cases analyzed here represent the ABCC Hiroshima autopsy series from 1949 through 1959. Post mortem examinations on stillbirths and neonatal deaths that were collected during the years 1948 through 1953 were excluded from consideration because such cases are not pertinent to the general problems under study. With this limitation 1304 cases were available for matching. In 139 of these cases the death certificates were not available through the mechanisms of the overall study, so 1165 cases remained. Before comparisons are made the most important questions that must be answered about the materials and methods of the present investigation are: (1) is the autopsy-death certificate series a representative sample of all deaths in the population; (2) are the autopsy diagnoses correct; (3) are the death certificates properly understood and coded; and (4) are biologically meaningful groupings chosen for comparison between autopsy cause of death and death certificate cause of death. Because it is not possible to provide exact answers to all of these questions the doubt that they raise must be admitted but evaluated in the perspective of that part of the answer which is known.

21027 **(ABCC—19-61) Adult cytomegalic inclusion disease in leukemia and malignant lymphoma. Report of two cases with concomitant pneumocystis infection.** Nakamura, R.M.; Ichimaru, Michito; Izeki, Tetsuya. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1961. Contract AC01-76EV03081. 37p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008089.

Two cases of cytomegalic inclusion disease complicating chronic granulocytic leukemia and subacute lymphocytic leukemia in adult Japanese males in Nagasaki, Japan are reported. Both cases had concomitant pulmonary infection by pneumocystis carinii and both were exposed to the atomic bomb in 1945. It is believed these are the first reported autopsy cases of adult cytomegalic inclusion disease in which typical cytomegalic inclusion bodies were seen in the parenchymal cells of the salivary glands. Previously reported cases of adult cytomegalic inclusion disease complicating leukemia and malignant lymphoma are briefly summarized. Present knowledge of the relationship between cytomegalic and pneumocystis infections and association with lymphoma and leukemia is reviewed. The possible roles of chemotherapeutic agents and of radiation in the development of the cytomegalic and pneumocystis infections are also briefly discussed. 43 references, 4 figures, 2 tables.

21028 **(ABCC—19-62) ABCC-JNIH Adult Health Study, Hiroshima and Nagasaki 1958-1960; height-weight tables.** Seigel, D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Nov 1962. Contract AC01-76EV03081. 21p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008394.

From measurements taken in the Adult Health Study in Nagasaki and Hiroshima, tables of weight have been compiled. They are presented in the metric system, specific for height, sex, and age group. Five percentiles are presented as a guide for describing the distribution of weights. These values represent smoothing of the original data. This was accomplished by fitting second degree regression equations by least squares to the relationship of the logarithm of weight on height, separately for each age-sex group. This provided medians; other percentiles were obtained by adding or subtracting a term of the form KS, where K was taken from a table of normal deviates, and S was estimated from the data. The use and limitations of the tables were discussed. 10 tables.

21029 **(ABCC—19-63) ABCC-JNIH Adult Health Study. Report 3. 1958-1960 cycle of examinations, Hiroshima.** Finch, S.C.; Anderson, P.S. Jr. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 29 Oct 1963. Contract AC01-76EV03081. 64p. (In Japanese and English). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008083.

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Results of 10,368 examinations of participants in the ABCC-JNIH Adult Health Study, Hiroshima, were tabulated and discussed. About 82% of the entire sample was examined at least once during the 1958-60 cycle. Physical and laboratory findings as well as major diagnoses were considered by comparison group, age, and sex. 8 references, 7 figures, 13 tables.

21030 **(ABCC—20-59) Growth and development of Hiroshima children exposed to the atomic bomb. Three-year study (1951-1953).** Reynolds, E.L. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 7 Feb 1961. Contract AC01-76EV03081. 170p. (In Japanese and English). NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84008082.

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This is the fifth in a series of reports dealing with the growth and development program of the Atomic Bomb Casualty

Commission (ABCC). The present report of the three-year study as a whole, has two main objectives: (1) a brief recapitulation of the 1951 and 1952 findings, and a summary of the combined analysis of some of the data; (2) the recording of a rather large amount of basic data in the growth and development area, so that subsequent studies may be done, if desired, on possible later effects of atomic radiation received prenatally, in infancy, or in early childhood. For this purpose, there is appended a listing of the ABCC master file numbers of all the children studied during the three-year period. These five studies form a whole, and should be considered as such. The present report, therefore, contains only a minimum of repetition of previous reports. Research in growth and development at ABCC is a part of the pediatric program as a whole. The same children are studied as are examined in the clinical sections of the program. Therefore, certain background data are identical for both studies. Included are such items as historical aspects of the program, the composition and origin of the sample studied, general methodology used, and certain background information such as birthplace of the children, past residence, present residence, and occupation and socioeconomic status of the parents. 22 figures, 77 tables.

21031 **(ABCC—20-60) Audiometric changes with age in Hiroshima: a statistical study.** Hollingsworth, J.W.; Ishii, Goro. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Oct 1960. Contract AC01-76EV03081. 19p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008484.

Audiometry observations were analyzed for 290 irradiated survivors of the 1945 atomic bomb in Hiroshima and in 293 nonirradiated subjects. The study was undertaken in order to determine the age changes in audiology in irradiated and nonirradiated subjects as well as to investigate the pattern of hearing levels in a Japanese population for comparison with patterns in Caucasians. The following statistical observations were made. Correlation between hearing levels for right and left ear. Correlation between hearing levels at various cycles. Changes in hearing levels by age and sex. The relation between age and decibel loss was not linear and correlation ratios with age were 0.45 to 0.72. Audiometry seems to be of some value as one of a battery of tests of physiologic aging designed for detection of irradiation induced nonspecific aging acceleration. In this relatively small sample, no differences in hearing acuity were detected in the atomic bomb survivors as compared with the control sample. 6 references, 3 figures, 9 tables.

21032 **(ABCC—20-61) Analysis of early mortality rates following the atomic bomb - Hiroshima.** Ishida, Morihiro; Matsubayashi, Ikuzo. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 20 Sep 1962. Contract AC01-76EV03081. 15p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008433.

Initial mortality due to the atomic bomb in Hiroshima City was analysed in relation to time lag from the bombing using data from the Atomic Bomb Casualty Census conducted by Hiroshima City during August 1946. Since the population located beyond 2000 meters from the hypocenter at the time of the bombing had received relatively small doses of radiation, it may be assumed that mortality in this group is almost entirely attributable to mechanical injuries caused by the bombing. On this assumption, mortality rates due to mechanical injury appear as a straight line in the logarithmic scale when considered as a function of distance from the hypocenter. Mortality rates at various distances from the hypocenter decreased with increasing time after the bombing. The mortality rate in the population irradiated within a short distance, e.g., 1500 meters from the hypocenter, was excessively high due to radiation injuries in addition to mechanical injuries within the first two months after the bombing. 4 references, 5 figures, 2 tables.

21033 **(ABCC—20-62) Electrocardiographic findings related to aging.** Ueda, Shoichi; Yano, Katsuhiko. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Dec 1962. Contract AC01-76EV03081. 46p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008396.

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More than 3000 electrocardiographic tracings for the ABCC-JNIH Adult Health Study Sample were studied to detect any specific abnormalities or nonspecific age changes in relation to possible radiation effects upon the cardiovascular system. The 4 comparison groups were studied with respect to the prevalence of electrocardiographic abnormalities and an electrocardiographic aging index which was defined to evaluate physiological change with age. Statistically significant differences were observed in the following aspects: In males aged 50 to 59, the prevalence of major electrocardiographic abnormalities was highest in the group located nearest the hypocenter. This was not observed in other age groups. In females, the prevalence of QRS high voltage was highest in Group 2 but low in Group 1. This trend was consistent in all age groups. These findings were not fully accounted for by differences in blood pressure, heart size, body weight or serum cholesterol values. In the age trend curve of the electrocardiographic aging index, a difference was observed among comparison groups in both sexes. This difference in electrocardiographic aging index is mainly attributed to T/sub I/ amplitude for males and R/sub II/ amplitude and QRS axis for females. Interpretation of these findings is rather difficult since very little has been known about radiation effects upon the cardiovascular system in humans. Further intensive studies are desired on the basis of the clues suggested in this report. 16 references, 3 figures, 31 tables.

21034 **(ABCC—20-63) ABCC-JNTH Adult Health Study. Report 4. 1960-1962 cycle of examinations, Hiroshima and Nagasaki.** Freedman, L.R.; Fukushima, Kazuko; Seigel, D.G. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 29 Oct 1963. Contract AC01-76EV03081. 134p. (In Japanese and English). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84008464.

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The purpose is to determine by clinical investigation any late medical effects of radiation in persons exposed to the 1945 atomic bombings of the cities of Hiroshima and Nagasaki. The prevalence and incidence of certain findings were found to be different in Hiroshima and Nasasaki. For example, tuberculosis, neoplasms of the digestive organs, gastric ulcer, diseases of the thyroid, diabetes mellitus, blood diseases, and arteriosclerosis were more frequent in Hiroshima. On the other hand, syphilis, cerebrovascular accidents, intestinal parasitism, liver and kideny disease, and arthritis were more frequent in Nagasaki. The data from the hematological examinations demonstrate a decrease in hemoglobin and hematocrit with increasing age in men. In both sexes total white blood cell counts decreased with age and the values for males were higher than those for females. Total white blood cell counts in Hiroshima were higher than in Nagasaki. The need continues for superimposition of a number of epidemiologic investigations onto the basic structure of the Adult Health Study to better define and explore the differences between cities. These substudies will undoubtedly provide a more precise foundation for the study of radiation effects and further understanding of important diseases. Finally, since this study brings together scientists from two parts of the world, patterns of disease detected in Japan inevitably were compared with personal and published experience in the United States. Many suspected differences between these countries have been commented upon in the medical literature. The Adult Health Study is contributing data which will establish or deny these differences. 147 references, 18 figures, 35 tables.

21035 **(ABCC—20-66) Cytogenetic studies in exposed survivors, Hiroshima and Nagasaki.** Bloom, A.D.; Neriishi, Shotaro; Kamada, Nanao; Iseki, Tetsuya; Keehn, R.J. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 21 Jul 1966. Contract AC01-76EV03081. 13p. (In Japanese and English). (TID—23420). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008099.

Ninety-four exposed atomic bomb survivors together with their comparison subjects, matched for age and sex, were studied in Hiroshima and Nagasaki. All subjects were less than 30 years of age ATB, and all were within 1400 m from the hypocenter. Of the exposed, 33 patients (34%) were found to harbor chromosomal abnormalities in 1% to 4% of their peripheral leukocyte metaphases. No direct relationship to dose or clinical symptoms of radiation sickness ATB could be found, and both sexes were equally effected. All individuals are clinically normal at this time. 15 references, 2 figures, 1 table.

21036 **(ABCC—21-59) Effect of exposure of parents to the atomic bombs on the first generation offspring in Hiroshima and Nagasaki: preliminary report. Studies on the potential genetic effects of the atomic bombs. Radiation and the sex ratio in man.** Neel, J.V.; Morton, N.E.; Schull, W.J.; McDonald, D.J.; Kodani, M.; Takeshima, K.; Anderson, R.C.; Wood, J.; Brewer, R.; Wright, S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 50p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008483.

This document contains 3 separate reports on studies of genetic radiation effects on survivors of the atomic explosions on Hiroshima and Nagasaki. Separate abstracts have been prepared for each report for inclusion in the Energy Database. (DMC)

21037 (ABCC—21-59, pp 12p, Paper 1) **Effect of exposure of parents to the atomic bombs on the first generation offspring in Hiroshima and Nagaski: preliminary report.** Neel, J.V.; Morton, N.E.; Schull, W.J.; McDonald, D.J.; Kodani, M.; Takeshima, K.; Anderson, R.C.; Wood, J.; Brewer, R.; Wright, S. 1959. (In Japanese and Engish). NTIS, PC A03/MF A01.

In Effect of exposure of parents to the atomic bombs on the first generation offspring in Hiroshima and Nagaski: preliminary report. Studies on the potential genetic effects of the atomic bombs. Radiation and the sex ratio in man.

For the past seven years, investigations have been carried out in Hiroshima and Nagasaki by the Atomic Bomb Casualty Commission on the delayed effects of exposure to atomic bombs. This communication is concerned with the results of a preliminary analysis of a part of the data collected, that concerned with effects on the first generation offspring of exposed parents. 5 tables.

21038 (ABCC—21-59, pp 17p, Paper 2) **Studies on the potential genetic effects of the atomic bombs.** Neel, J.V.; Schull, W.J. 1959. (In Japanese and Engish). NTIS, PC A03/MF A01.

In Effect of exposure of parents to the atomic bombs on the first generation offspring in Hiroshima and Nagaski: preliminary report. Studies on the potential genetic effects of the atomic bombs. Radiation and the sex ratio in man.

The study described was undertaken as one facet of a comprehensive attempt to obtain information concerning the various possible delayed biological effects of exposure to an atomic bombing. So well known are the genetic effects of irradiation that inevitably one of the foremost questions in the minds of those considering the possible late consequences had to do with the characteristics of the children of exposed parents. We shall report on certain efforts made during the year 1946 to 1955 to answer the following two questions: (1) Can there be observed, during the first year of life, any differences between the children born to parents, one or both of whom were exposed to the effects of the atomic bombings of Hiroshima and Nagasaki, and the children born to suitable control parents, and (2) If differences do exist, how are these to be interpreted. 2 figures, 3 tables.

21039 (ABCC—21-59, pp 15p, Paper 3) **Radiation and the sex ratio in man.** Schull, W.J.; Neel, J.V. 1959. (In Japanese and Engish). NTIS, PC A03/MF A01.

In Effect of exposure of parents to the atomic bombs on the first generation offspring in Hiroshima and Nagaski: preliminary report. Studies on the potential genetic effects of the atomic bombs. Radiation and the sex ratio in man.

An analysis of new data concerning the sex of children born to the survivors of the atomic bombings of Hiroshima and Nagasaki, together with a reanalysis of the data previously presented by Neel and Schull, reveals significant changes in the sex ratio of these children, changes in the direction to be expected if exposure had resulted in the induction of sex-linked lethal mutations. 16 references, 2 figures, 5 tables.

21040 **(ABCC—21-61) Serum butanol extractable iodine values for adolescents exposed in utero - Nagasaki.** Burrow, G.N.; Hamilton, H.B.; Man, E.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Oct 1961. Contract AC01-76EV03081. 15p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008397.

Serum BEI determinations were performed on 249 fifteen year old exposed and nonexposed apparently normal children all of whom were in utero at the time of the atomic bombing in Nagasaki, Japan. The girls were more mature in growth and development than the boys; the boys were probably near the peak stress of adolescent development. No statistically significant difference of BEI values was found between exposed and control groups. The trimester of gestation of the children at the time of exposure appeared to have no conclusive effect on the BEI value, but the number of subjects from each trimester was too small for satisfactory statistical analysis. Eleven females with goiter were analyzed separately. There was a slight preponderance of goiter in the exposed group, but the difference was not significant. The mean BEI value for the males was significantly lower than that for the females. The mean BEI values for Japanese adolescents are higher than for adolescents in the Middle Atlantic and New England states in the United States. 31 references, 2 tables.

21041 **(ABCC—21-62) ABCC-JNIH Adult Health Study, Hiroshima 1958-1960. Cardiovascular Project Report 3. Prevalence of cardiovascular diseases related to associated factors.** Ueda, Shoichi; Yano, Katsuhiko. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Dec 1962. Contract AC01-76EV03081. 28p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008455.

A long-term follow-up investigation of cardiovascular disease was organized primarily as an intensive substudy of the ABCC-JNIH Adult Health Study and secondarily for epidemiologic comparison with data on the Framingham, Massachusetts, population. One of the purposes of the present cardiovascular studies on a Hiroshima population was to obtain data comparable with that of the Framingham Study. An equally important aspect of the Hiroshima study is to explore radiation effects on the cardiovascular system. The sample is the Adult Health Study population and consists of 13,000 males and females in Hiroshima. This report provides the prevalence of cardiovascular disease in the first cross-section examined during 1958-1960 together with certain information on related factors. The overall attrition rate was 25%; 15% was caused by death or migration before the examination and 10% by refusal to participate. No significant difference was found in the blood pressure levels between the nonrespondents and the respondents in comparison with results of prior examinations at ABCC. The prevalence of various cardiovascular diseases was analyzed by sex and age. The analysis also extended to relationship of blood pressure, serum cholesterol, body weight, heart size, and occupation, with the prevalence of coronary heart disease for the sample over 40 years of age. 12 references, 15 tables.

21042 **(ABCC—21-63) Study of adolescents exposed in utero: clinical and laboratory data 1958 to 1959, Nagasaki. Report 1. General aspects.** Burrow, G.N.; Hamilton, H.B.; Hrubec, Z.; Amamoto, K.; Matsunaga, F.; Brill, A.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Oct 1963. Contract AC01-76EV03081. 30p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008398.

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An intensive two-year study of 286 Nagasaki adolescents, ages 13 to 14, was conducted as part of a long term program to determine possible differences in growth and development which might be attributed to in utero exposure to the atomic bomb. Three comparison groups were studied: Group I whose mothers were 0 to 1999 m from the hypocenter; Group II whose mothers were 3000 to 4999 m from the hypocenter; Group III whose mothers were not in the city at the time of the bomb. A significantly higher frequency of mental retardation and minor congenital malformations were found in Group I males but not in the females. Although Group I females who were in the 1st trimester of gestation at the time of the bomb and whose mothers experienced the acute radiation syndrome had poorer visual acuity than comparable children of asymptomatic mothers, the small number of observations requires caution in interpretation of this finding. Parasitic infestation occurred in about one third of the subjects, and Group I had significantly greater infestation than did the other comparison groups. Trichocephalus and Ascaris infestation accounted for the higher prevalence in Group I. Hookworm occurred less frequently. It was suggested that these

findings probably are associated with differences in dietary and living habits. No cases of leukemia or malignancy were found, but the sample was not large enough to detect even a 10-fold increase in incidence. No consistent significant differences attributable to a radiation effect were noted among the comparison groups in regard to radial pulse, blood pressure, hematologic or urologic examinations. 43 references, 1 figure, 17 tables.

21043 **(ABCC—21-64) Epidemiology of urinary tract infections in Hiroshima.** Freedman, L.R.; Phair, J.P.; Seki, Masafumi; Hamilton, H.B.; Nefzger, M.D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Aug 1964. Contract AC01-76EV03081. 31p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008458.

The present study was conducted at ABCC on a sample of Hiroshima residents systematically seleced for determining the influence on general health status of exposure to the atomic bomb of 1945. A survey for urinary infections was taken on persons in the sample examined in the ABCC clinic over a 1-year period: approximately 3000 women and 2000 men. The purpose of the study was to determine the prevalence of urinary infection and to study the relation between bacteriuria and various aspects of the general examination, particularly blood pressure. In addition, the rates of urinary tract infection in the clinic were compared with the rates of chronic pyelonephritis at autopsy. Results showed that infections were much more common in women than in men and rose with age in both sexes. The greatest increase in the prevalence was found in women age 60 years and over was due to coliform bacteria in all but a few instances. There was no difference in hematuria, glycosuria, diabetes, serum cholesterol, blood groups, electrocardiograms, audiometry, vibrometry, hemoglobin levels or height-weight ratios. Blood pressure is higher in infected women as compared with noninfected women and the finding of higher rates for cardiac enlargement suggests that this small difference in blood pressures may have biological significance. However, the data do not permit a conclusion as to whether the urinary infections were responsible for the higher blood pressure levels, or whether the higher blood pressure levels increased the frequency of detectable infection. The difference between the clinical rates of urinary infection in men and women, and the pathological diagnosis of pyelonephritis in the same population, supports a previous suggestion that much of what is called pyelonephritis at autopsy is not due to urinary tract infection. 27 references, 2 figures, 10 tables.

21044 **(ABCC—22-59) Scars remaining in atom bomb survivors: a four year follow-up study. The status of lenticular opacities caused by atomic radiation, Hiroshima and Nagasaki, Japan, 1951-1953.** Wells, W.; Tsukifuji, Neal; Sinskey, R.M. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 37p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008156.

Two studies on injuries suffered by survivors of the atomic explosions on Hiroshima and Nagasaki are described. Separate abstracts have been prepared for each paper for inclusion in the Energy Database. (DMC)

21045 (ABCC—22-59, pp 20p, Paper 1) **Scars remaining in atom bomb survivors: a four year follow-up study.** Wells, W.; Tsukifuji, Neal. 1959. (In Japanese and English). NTIS, PC A03/MF A01.

In Scars remaining in atom bomb survivors: a four year follow-up study. The status of lenticular opacities caused by atomic radiation, Hiroshima and Nagasaki, Japan, 1951-1953.

Ninety persons surviving burns or other wounds incident to atom bomb explosions in Hiroshima and Nagasaki were examined by Block and Tsuzuki between December 1946 and April 1947. Sixty-three of these patients have been re-examined after an interval of 48 to 54 months. Forty of the 63 patients were originally described as having scars compatible with keloid. All evidence of keloid has disappeared in 15 of this number. All of the 63 patients examined had normal or excessive scar 4 years ago. Fifty-seven of this number are improved or well; 1 remains unimproved; and 5 present objective and subjective evidence of being worse. The latter group is classified as worse because of tension scars associated with crippling contractures or cosmetic deformity. Patients exposed, with radiation illness, and patients exposed, without radiation illness, showed no significant or impressive difference in their response to initial injury, or in the healing of donor or recipient areas where grafts were used. No case was discovered which resembled a cutaneous radiation injury. In every case excessive scarring has disappeared or shown appreciable decrease in size, except where persistence has been provoked by infection, foreign bodies, contractures, or abnormal skin tension. The authors conclude that the clinical course of burns and other injuries in 28 patients who gave a history of acute radiation illness after atom bomb detonations in 1945 has not differed significantly from the clinical course of 35 patients injured at the same time but without a history of radiation illness, and that the amount and the behavior of the scars received are not inconsistent with the immediate and subsequently available therapy. 1 reference, 19 figures, 3 tables.

21046 (ABCC—22-59, pp 13 p, Paper 2) **Status of lenticular opacities caused by atomic radiation, Hiroshima and Nagasaki, Japan, 1951-1953.** Sinskey, R.M. (Duke Univ. Medical School, Durham, NC). 1959. (In Japanese and English). NTIS, PC A03/MF A01.

In Scars remaining in atom bomb survivors: a four year follow-up study. The status of lenticular opacities caused by atomic radiation, Hiroshima and Nagasaki, Japan, 1951-1953.

Inconspicuous changes in the lens in the form of posterior subcapsular plaques, which have previously been interpreted as normal, are shown statistically to be significant effects of nuclear radiations from the atomic bombs dropped over Hiroshima and Nagasaki. It is evident that morphologic characteristics of radiation cataracts may be confused readily with lenticular opacities of other etiologies which occur primarily in the postsubcapsular region axially. The incidence of these posterior subcapsular plaques can be correlated with age, epilation, shielding, and distance from ground zero. Sex has no effect on incidence studies. The posterior subcapsular opacities observed over a four-year period were increasing very slowly or not at all. The various stages of opacification of the lens caused by nuclear radiation are described and illustrated. The atomic bomb explosion in Hiroshima on August 6, 1945, has resulted in negligible loss of vision to date. The utilization of the earliest signs of radiation changes in the lens as an additional method for the protection of the atomic plant worker is advocated. 10 references, 11 figures.

21047 **(ABCC—22-60) Epidemiologic evaluation of ABCC autopsies, Hiroshima, 1950-1959.** Stone, R.S.; Anderson, P.S. Jr. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Sep 1961. Contract AC01-76EV03081. 42p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008466.

The present report is based on a general survey of epidemiologic characteristics of the autopsy cases, other than the genetics study group, examined in the ABCC Department of pathology at Hiroshima from its inception through 1959; somewhat more than ten years. A total of 1304 cases is available for study. 33 references, 22 tables.

21048 **(ABCC—22-61) Multivariate analysis and the IBM704 computer applied to ABCC data on growth of surviving Hiroshima children.** Nehemias, J.V. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 6 Nov 1961. Contract AC01-76EV03081. 65p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008106.

Little information has been available upon which to base inferences concerning the effects of ionizing radiation upon the growth and development of humans. This paper briefly discusses the pertinent data available and the design and use of specific statistical analyses to test for correlations of growth parameters with exposure parameters, and differences among exposure groups. Multivariate analysis techniques are used, with twelve anthropometric measurements as variables. Numerical computations were programmed for and performed on an IBM704 high-speed computer. Four conclusions may be drawn concerning the children included in the sample, on the basis of these analyses. The groups of nonexposed children examined in the ABCC program differ with respect

to anthropometric variables from the corresponding groups of exposed children more than the latter vary among themselves. Differences with respect to size which are statistically very significant are found among the subgroups defined on the basis of the radiation exposure index. There is no evidence of bias with respect to anthropometric variables or radiation parameters in whether or not a child returned for subsequent examinations. The use of anthropometric data from subsequent examinations in comparisons of growth rate and change of growth rate cannot be rejected on the basis of these tests for bias. No significant differences have been shown to exist at the younger age levels with reference to growth rate or rate of change of growth rate. Although it must be presumed that these children experienced such dynamic growth differences in the period immediately following the bombing, no evidence of this was observed in 1951. Highly significant differences among exposure groups were observed with respect to growth rate and change of growth rate at the older age levels. 14 references, 7 figures, 18 tables.

21049 **(ABCC—22-62) Cardiovascular disease in relation to exposure to ionizing radiation. ABCC-JNIH Adult Health Study Hiroshima 1958-60. Cardiovascular Project Report 4.** Yano, Katsuhiko; Ueda, Shoichi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 12 Dec 1962. Contract AC01-76EV03081. 26p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008467.

The prevalence of cardiovascular disease in Hiroshima atomic bomb survivors was analyzed for a possible radiation effect. Suggestive differences among comparison groups were observed concerning: High blood pressure in both sexes; Prevalence of coronary heart disease in females; and Age change in serum cholesterol level in males. It is not clear, however, from the present data whether these differences are radiation effects per se or concomitant effects of differences in environmental factors or even in accuracy of diagnosis. These points will be further investigated as follow-up data become available. 15 references, 2 figures, 17 tables.

21050 **(ABCC—22-63) Exposure to medical x-ray. Chest x-ray examinations in community hospitals and at ABCC. Bone marrow and gonadal dose estimates.** Ihno, Yu.; Russell, W.J.; Ishimaru, Toranosuke. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Oct 1963. Contract AC01-76EV03081. 18p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008107.

From July to November 1962, the Department of Radiology, Atomic Bomb Casualty Commission (ABCC), Hiroshima, conducted a survey in which subjects routinely examined at ABCC were interrogated regarding medical x-ray examinations received in the community hospitals and clinics. Technical information regarding the exposures was obtained November 1962-January 1963 in a survey of the responsible community hospitals and clinics. The latter survey provided detailed information including manufacturer, type of x-ray apparatus, and in many instances exposure factors used by each facility covered by the survey and the results have also been reported. Gonadal and bone marrow dose values were calculated according to the methods and data of Epp et al, for chest examinations. Methods of application and results are described. The data were readily applied to procedures used at ABCC, but not to those used in community hospitals and clinics because of their wind variations in factors. For this reason, they were applied to PA chest examinations only in case of these institutions. 3 references, 12 figures, 3 tables.

21051 **(ABCC—23-59) Hematologic studies of irradiated survivors in Hiroshima, Japan. Refractory anemia occurring in survivors of the atomic bombing in Nagasaki, Japan.** Yamasowa, Yoshimichi; Lange, R.D.; Wright, S.W.; Tomonaga, Masanobu; Kurasaki, Hirotami; Matsuoka, Shigeru; Matsunaga, Haruji. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 29p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008109.

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This document contains 2 reports on the effects of radiation on the survivors of the atomic explosions in Hiroshima and Nagasaki. The first report is a hematologic survey conducted 33 to 44 months after the detonation of the atomic bomb in Hiroshima, Japan. The hematologic findings on a total of 824 survivors are compared with those on a control group of 1145 residents of Kure. Although statistical differences are apparent in the two groups, when one takes into account errors inherent in the hematologic methods themselves and differences in the possible incidence of parasitism and nutrition it would be unwarranted to attribute the slight changes found to radiation effect. The data presented here seem to indicate that radiation resulting from the explosion of the atomic bomb in Hiroshima, on August 6, 1945, has not significantly varied the hematologic values as analyzed in this report over a three-to four-year period. In the second report, the case histories of six Nagasaki atomic bomb survivors who developed refractory anemia are presented. Four of these individuals received undoubted radiation injury. The fact that refractory anemia may occur as a late manifestation of exposure to atomic radiation is pointed out. 15 references, 5 figures, 2 tables.

21052 **(ABCC—23-60) Statistical evaluation of physical examinations conducted under atomic bomb survivors medical treatment law Nagasaki.** Ohri, Shigehisa; Shimada, Daisaburo; Ishida, Morthiro; Onishi, Shigeyuki. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Sep 1961. Contract AC01-76EV03081. 15p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008460.

An evaluation was made of the reliability and validity of the information obtained by the first examination completed under the ABSMTL. Results of the analysis show clearly that the materials hardly can be utilized for studying the relationship between findings obtained from the medical examination and distance from the hypocenter. From the standpoint of clinical medicine, the lack of exactness in the examinations may be a major difficulty. However, as long as the degree of inexactness of the medical examinations is distributed equally to all sample members, comparison of the findings may be made within the limits of their accuracy. 4 references, 1 figure, 3 tables.

21053 **(ABCC—23-63) Tumor registry data, Hiroshima and Nagasaki 1957-1959: malignant neoplasms.** Harada, Tomin; Ide, Masao; Ishida, Morihiro; Troup, G.M. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 3 Oct 1963. Contract AC01-76EV03081. 61p. (In Japanese and English). NTIS, PC A04/MF A01. Order Number DE84008456.

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The report concerns three aspects of the Hiroshima and Nagasaki Tumor Registry data, 1957-1959: comparability, reliability and validity of incidence rates of malignant neoplasms obtained from the Tumor Registries and various statistical problems of registered data related to the Life Span Study sample and Adult Health Study sample; incidence rates of main site of malignant neoplasms obtained from the Tumor Registries are compared with those of the United States and Denmark; and incidence of malignant neoplasm among Hiroshima and Nagasaki A-bomb survivors. 15 references, 7 figures, 30 tables.

21054 **(ABCC—24-59) Outcome of pregnancy in women exposed to the atomic bomb in Nagasaki. Atomic bomb exposure and the pregnancies of biologically related parents. A prospective study of the genetic effects of ionizing radiation in man.** Yamazaki, J.N.; Wright, S.W.; Wright, P.M.; Schull, W.J.; Neel, J.V. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 44p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008482.

This document contains 2 reports. In the first report a study has been made of the outcome of pregnancy in women who were pregnant at the time of the atomic bomb explosions in Nagasaki. Among 30 mothers with one or more major signs of radiation, i.e., epilation, oropharyngeal lesions, purpura, or petechiae, who were within 2000 meters of the hypocenter, there were 7 fetal deaths (23.4%), 6 neonatal and infant deaths (26%), and 4 instances of mental retardation among 16 surviving children (25%). The overall morbidity and mortality is approximately 60% in this group of mothers. This is in sharp contrast to the group of mothers without

major signs but within 2000 meters, where the overall mortality was only 10%, and in the control group, where it was about 6%. In the second and third trimesters there is a significantly greater fetal, neonatal, and infant mortality among the mothers with major signs when compared to the mothers without major signs or the control group. The mean height and head circumference of children born to mothers with major signs was significantly smaller than in those children born to mothers in the control group. In the second report, the effects of radiation exposure on the progeny of biologically related parents are discussed. The concepts and particularly the technics of modern epidemiology are surprisingly similar to those which the geneticist associates with what he terms population genetics. It is one of the purposes of this presentation to indicate this parallelism in approaches through a consideration of a study of the genetic effects of ionizing radiation in man. While the data to be reported have not previously appeared in the literature, methodology is emphasized here rather than data. 59 references, 3 figures, 11 tables.

21055 **(ABCC—24-63) Dose to the gonads and bone marrow in radiographic examinations at ABCC.** Ihno, Yu; Russell, W.J. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Nov 1963. Contract AC01-76EV03081. 10p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008471.

Gonadal and bone marrow dose from diagnostic x-ray exposure are of special interest to the Atomic Bomb Casualty Commission (ABCC) program because of its study of the late effects of radiation, and the prevalence of leukemia in the populations which experienced the atomic bombings. A consideration in these studies is the contribution of diagnostic x-ray procedures to the overall exposure of subjects under continued medical study at ABCC. To assess dose contribution of diagnostic x-ray examinations, ABCC subjects were interrogated as to frequency and location of such exposures in community hospitals and clinics in Hiroshima and Nagasaki. This informtion plus that obtained from the community hospitals and clinics were combined in an attempt to assign gonadal and bone marrow dose by various x-ray examinations but the wide variations in exposure factors prevented application of other investigators dose data to the situations in Hiroshima and Nagasaki community hospitals and clinics. Therefore, a dosimetry program was undertaken and is currently in progress. The present work consists of the application of data compiled by Epp et al to the radiographic examinations frequently employed in the ABCC Department of Radiology. These dose values are expressed for each exposure, and for each examination including those requiring multiple exposures. 6 references, 2 tables. (DMC)

21056 **(ABCC—25-59) Leukemia in atomic bomb survivors. 1. General observations. Leukemia in survivors of atomic bombing. Cytologic and biochemical studies on the granulocytes in early leukemia among atomic bomb survivors. Leukemogenic effects of ionizing radiation on atomic bomb survivors in Hiroshima City.** Lange, R.D.; Moloney, W.C.; Yamawaki, Tokuso; Kastenbaum, M.A. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 44p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008110.

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This document contains 4 separate reports on leukemia in survivals of the atomic explosions in Hiroshima and Nagasaki. In the first report, observations on seventy-five established cases of leukemia occurring in people exposed to atomic bomb radiation are presented. These data indicate a great increase in the incidence of leukemia among atomic bomb survivors due to a single massive exposure to ionizing radiation. The leukemogenic effects of radiation are manifested equally in both sexes and at all age levels represented in this series. The striking preponderance of chronic myelogenous leukemia compared to chronic lymphatic leukemia has been noted in exposed individuals but it is pointed out that chronic lymphatic leukemia is comparatively rare among the Japanese. Cases of leukemia are still appearing in atomic bomb survivors. However, since 1950 there has been a steady decline in the number of cases. The second report consists of a review of all cases of leukemia referred to the ABCC from 1948 to April 1952, a total of 75 cases. In the third report, hematological and biochemical findings in separated leukocytes of four cases of preclinical myelogenous leukemia developing in atomic bomb survivors are described. The incidence of leukemia among survivors in Hiroshima is the topic of the fourth report. 38 references, 8 figures, 10 tables.

21057 **(ABCC—25-60) Pseudohypoparathyroidism and hypothyroidism: a case report, Hiroshima.** Turner, R.W.; Takamura, Tsugiso. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Feb 1961. Contract AC01-76EV03081. 15p. (In Japanese and English). NTIS, PC A02/MF A01. Order Number DE84008472.

The purpose of this report is to present what possibly is the second case of pseudohypoparathyroidism known in Japan and to describe another documented coincidence of pseudohypoparathyroidism and hypothryoidism in a single individual. 11 references, 4 figures.

21058 **(ABCC—26-60) Hematological findings for children exposed in utero, Hiroshima.** Takamura, Tsugiso; Ueda, Shoichi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 18p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008098.

For children irradiated in utero and nonirradiated children of Hiroshima hematologic findings between the years 1950 to 57 have been compared, and no changes peculiar to the irradiated group were found. Despite several predisposing factors toward the development of iron deficiency in Japanese children, overt anemia was rare and distribution of hemoglobin levels was only slightly lower than reported for American and European children. Leukocyte levels, irrespective of age of the children, were found to be progressively falling in Hiroshima children so that by 1957 the values were distinctly lower than those reported for normal children in Japan and the United States. No cause for this change was apparent. 19 references, 7 figures, 3 tables.

21059 **(ABCC—26-64) Estimate of person-years at risk among A-bomb survivors, Hiroshima and Nagasaki.** Hrubec, Z. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Nov 1964. Contract AC01-76EV03081. 52p. (In Japanese and English). NTIS, PC A04/MF A01. Order Number DE84008473.

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Using information from the Supplementary Schedules of the 1950 National Census and from the JNIH-ABCC Life Span Study, cumulative person-years at risk in 1950 to 1960 were estimated by age ATB, sex, distance from hypocenter, radiation dose and symptoms for A-bomb survivors resident in Hiroshima and Nagasaki cities. The number of person-years at risk in 1951 to 1958 was estimated by applying the survivorship in each age group of the Adult Health Study sample during the period 1951 to 1958 to the number of survivors in 1950. To determine the number of person-years at risk from 1959 to 1960, the average yearly loss was evaluated for each exposure group for the period 1955 to 1958 in Hiroshima and for 1953 to 1958 in Nagasaki which was then applied to 1959 and 1960, respectively. The estimate of person-years among the nonexposed groups for this period was obtained from the above estimates, the total population of both cities, and the number of persons born after the A-bombing. Estimates by other associated factors were obtained by the same procedure. 20 references, 25 tables.

21060 **(ABCC—27-60) Field studies on the health status of atomic bomb survivors. Provisional research plan.** Nobechi, Keizo; Toranosuke, Ishimaru; Wakabayashi, Toshiro; Jablon, Seymour. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Dec 1960. Contract AC01-76EV03081. 18p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008474.

The purpose of the proposed study are: to provide current and continuing information on significant illness which occurs among the exposed survivors and among controls; to provide information on the state of health of patients who refuse to participate in the AHS and permit explicit comparison of the health of those who do and those who do not participate; to help cement relationship between ABCC and members of the AHS by demonstrating that

ABCC has a continuing interest in patients' welfare and state of health; to provide information on the patterns of medical care employed by the sample members. Methods for interviews and data collection are described. (DMC)

21061 **(ABCC—27-64) Correlations between tests of aging in Hiroshima subjects: an attempt to define physiologic age.** Hollingsworth, J.W.; Hashizume, Asaji; Jablon, Seymour. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Dec 1964. Contract AC01-76EV03081. 19p. (In Japanese and English). NTIS, PC A02/MF A01. Order Number DE84008479.

Nine physiologic functions which change with age were measured in 437 subjects during their regular visits to the Atomic Bomb Casualty Commission clinic in Hiroshima, Japan. This pilot study was undertaken to determine the feasibility of collecting such data in a population sample physiologic age score. Tests conducted consisted of: skin elasticity, systolic blood pressure, vital capacity, hand grip strength, light extinction time, vibrometer, visual activity, audiometry, and serum cholesterol. The study demonstrated that adequate sample data could be obtained, and that statistical treatment could construct a physiologic age for individual subjects. However, the tests were of limited value below age 40, and the validation of the concept of physiologic age requires eventual correlation with mortality. Since the ABCC program includes a highly accurate mortality survey, it is hoped that data on physiologic aging can be collected and eventually related to mortality. 11 references, 3 figures, 6 tables.

21062 **(ABCC—28-59) Ophthalmologic survey of atomic bomb survivors in Japan, 1949. Atomic bomb radiation cataract case report with histopathologic study. Medical examination of Hiroshima patients with radiation cataracts.** Cogan, D.G.; Martin, S.F.; Kimura, S.J.; Ikui, Hiroshi; Fillmore, P.G. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 55p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008462.

This document contains 3 reports dealing with the delayed effects of radiation on the eyes of survivors of the atomic explosions in Hiroshima and Nagasaki. In the first study, 1000 persons who were listed as having been in the open and within two kilometers of the hypocenter at the time of the explosion were selected at random from the census files of the Atomic Bomb Casualty Commission for study. In addition, 231 others, comprising the total available number of surviving persons listed at present in the census files as having been within one kilometer of the hypocenter, were examined, as were several hundred others who were contacted through newspaper publicity, referrals from local ophthalmologists, or through hearsay. The survey resulted in bringing in persons having, or having had, a variety of ocular conditions. Those connected with the atomic bomb included the following diagnoses; multiple injuries of eyes and eyelids; keratoconjunctivitis from ultraviolet and ionizing radiations; thermal burn of the cornea and of the retina; retinitis proliferans; and radiation cataracts. The cataracts were the only delayed manifestations of ocular injury from the atomic bomb. The second paper is a case report of a histopathologic study of atomic bomb radiation cataract. The third paper presents the results of medical examinations of survivors having radiation induced cataracts. 32 references, 8 figures. (DMC)

21063 **(ABCC—28-60) Inventory of ABCC autopsies in Hiroshima.** Stone, R.S.; Hirose, F.M.; Anderson, P.S. Jr.; Yamamoto, T.; Hiramoto, T.; Murata, Y.; Oda, T.; Kimura, K.; Takamatsu, M.; Madden, S.C. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Sep 1960. Contract AC01-76EV03081. 54p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008461.

Data are tabulated from autopsy findings on A-bomb survivors in Hiroshima. The information is presented as a part of a layer study to investigate the delayed effects of ionizing irradiation. (DMC)

21064 **(ABCC—29-59) Atomic bomb injury: radiation.** Dunham, C.L.; Cronkite, E.P.; Le Roy, G.V.; Warren, S. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 38p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008434.

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This document contains 3 reports. In the first report, the clinical diagnosis and treatment of radiation syndrome in survivors of the atomic explosions in Hiroshima and Nagasaki are described. The syndrome of acute radiation injury is applied to the symptom complex, or diseased state, which results from exposure of the whole body to the initial nuclear radiation of an atomic bomb. It is applied to injuries of the skin and subcutaneous tissues resulting from x-radiation or from contact with radioactive material. Internal radiation injury may result from the selective deposition, such as in bone or thyroid, of radioactive material that has been inhaled or absorbed through the gastrointestinal tract or wounds. Radiation syndrome is classified as very severe, severe, and mild. In the second report, a brief discussion is presented on the question of genetic effects in atomic bomb survivors in Hiroshima and Nagasaki. In the third report, a study was carried out on 205 4-1/2 year old children who had been exposed to the atomic bomb blast during the first half of intra-uterine life. Correlation between head size and mental development of the child with distance from the hypocenter, symptoms of radiation effect and type of shielding of the mother is discussed. The conclusion drawn from the present study is that central nervous system defects can be produced in the fetus by atomic bomb radiation, provided that exposure occurs within approximately 1200 meters of the hypocenter and that no effective shielding, such as concrete, protects the fetus from direct irradiation.

21065 **(ABCC—29-64) Case Reports 1964: Radiology.** Watanabe, Noritoshi; Mandai, Tatsuo; Russell, W.J.; Yoshinaga, Haruma; Kogure, Takashi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 23 Apr 1964. Contract AC01-76EV03081. 22p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008465.

This document contains 2 reports. In the first report, a brief review of the history of the use of thorium dioxide is presented. Some of the difficulties encountered in estimating amounts of thorium in impregnated tissue, and making dose calculations are cited. Results of chemical analysis, radiographic and autoradiographic studies of tissues of a patient who received intravenous injection of thorotrast 22 years previously are also presented. Estimates of dose to the liver and spleen of this individual were 680 rem and 25,000 rem respectively. In the second report, a brief review of the literature in English and Japanese pertaining to prolapse or transmigration of esophageal mucosa is given. Synopses of symptoms and clinical findings with illustrations of five cases in whom this abnormality was detected are presented. Separate abstracts have been prepared for each report for inclusion in the Energy Data Base. 45 references, 5 figures. (DMC)

21066 (ABCC—29-64, pp 12p, Paper 1) **Postirradiation changes and dose determinations in thorium-impregnated liver and spleen.** Watanabe, Noritoshi; Mandai, Tatsuo; Russell, W.J.; Yoshinaga, Haruma. 23 Apr 1964. (In Japanese and English). NTIS, PC A02/MF A01.

In Case reports 1964: radiology.

A brief review of the history of the use of thorium dioxide is presented. Some of the difficulties encountered in estimating amounts of thorium in impregnated tissue, and making dose calculations are cited. Results of chemical analysis, radiographic and autoradiographic studies of tissues of a patient who received intravenous injection of thorotrast 22 years previously are also presented. Estimates of dose to the liver and spleen of this individual were 680 rem and 25,000 rem respectively. 35 references, 5 figures, 1 table.

21067 **(ABCC—30-59) Incidence of leukemia in survivors of the atomic bomb in Hiroshima and Nagasaki, Japan.** Folley, J.H.; Borges, W.; Yamawaki, Takuso. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 56p. (In Japanese and English). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008422.

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This document contains two reports. The aim of the first investigation was to obtain information concerning all individuals in Hiroshima and Nagasaki having onset of symptoms of leukemia or dying of the disease since the atomic explosion in 1945. Results show that: (1) There is a significant increase in the incidence of leukemia in the exposed populations of Hiroshima and Nagasaki as compared with the non-exposed populations of the two cities; (2) there is a significant increase in the incidence of leukemia within the exposed population of Hiroshima and Nagasaki in subjects exposed at distances less than 2000 meters from the hypocenter; and (3) The concept that radiation from the atomic bomb explosions in Hiroshima and Nagasaki is a leukemogenic agent in man is supported. In the second report, 10 patients were used to study the early hematologic and preclinical phases of leukemia in atomic bomb survivors. Findings are presented. 23 references, 13 figures, 15 tables.

21068 **(ABCC—31-59) Studies of Nagasaki (Japan) children exposed in utero to the atomic bomb: a roentgenographic survey of the skeletal system. Response of human beings accidentally exposed to significant fall-out radiation.** Sutow, W.W.; West, E.; Cronkite, E.P.; Conard, R.A.; Farr, R.S.; Browning, E.; Bond, V.P.; Shulman, R.; Cohn, S.H. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 29p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008435.

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This document contains 2 reports. In the first report, a roentgenographic survey of the skeletal system was made on 74 children who were exposed in utero to the atomic bomb explosion in Nagasaki, Japan at distances under 2000 meters from the hypocenter. The findings were compared with those on a group of 91 children also exposed while in utero to the bomb but at distances of 4000 to 5000 meters. No differences in the incidence of skeletal abnormalities were found between the two groups. In the second report, a description of injuries suffered due to fallout after the explosion of a thermonuclear device on the Marshall Islands is presented. Marshallese and Americans were accidentally exposed on islands in this area, receiving whole-body gamma radiation, beta radiation injury to skin, and minimal internal contamination. The highest dose (an estimated 175 r) was received by a group of 64 Marshallese. The dose of radiation received proved to be sublethal. Though there was significant depression of hemopoiesis, no clinical signs or symptoms developed that could be attributed with certainty to this effect. Skin lesions and epilation developed in 90% of the group beginning about two weeks after the exposure. Minimal amounts of radioactive material were detected in the urine. The internal deposition was insufficient to contribute significantly to the acute reaction, and it is believed there is no long-term hazard. Examinations conducted one year after the exposure revealed these people to be in generally good health. Slight depression of lymphocytes and platelets persisted. A few pigment aberrations and minimal atrophy remained at the site of the deeper skin lesions.

21069 **(ABCC—32-59) Delayed effects occurring within the first decade after exposure of young individuals to the Hiroshima atomic bomb.** Miller, R.W. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1956. Contract AC01-76EV03081. 34p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008421.

The review of the literature and the data presented in this report describe the late effects of exposure of young subjects to ionizing radiation or to nuclear weapons as known in the early part of 1955. The new information may be useful in the further definition of the tolerance of humans to ionizing radiation. In 6 years ending in December 1954, 19 persons who were within 2100 meters of the hypocenter have developed leukemia before attaining the age of 19 years. The annual incidence of this disease among those who were within 1500 meters and who were younger than 19 years of age at the time of exposure is 1:1000. There are no cataracts that impair vision among the present pediatic group. An increased incidence of a mild visual disability, the cause of which is thus far indefinite, has been found among those now 16 through 19 years of age who were within 1800 meters of the bomb center. The incidence of chronic otitis media is the same for the 2 exposure groups, as are the means of the hematologic values for the patients with this ailment. There is no increase in the tumor incidence of the exposed children as compared with the nonexposed. There are no data to prove it, but the impression is that among the survivors the fear of late effects may be common and potentially disabling. Of those 19 years of age and younger, there were 2771 within 3000 meters of the hypocenter at the time of detonation of the bomb who were examined in 1954. Twenty-four of these had sequelae of the blast or thermal effects of the bomb other than well-heated scars. No other abnormalities related to atomic bomb exposure have been identified.

21070 **(ABCC-TR—1-66) Report of dosimetry studies.** Antoku, Shigetoshi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 24 Feb 1966. Contract AC01-76EV03081. 66p. (In Japanese and English). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008120.

ABCC has made a number of assessments of dose to survivors due to ionizing radiation of the A-bombs. Also important is the contribution of medical x-ray to the cumulative dose to these individuals, especially since it could be of the same order as dose from the bombs among distally exposed or partially shielded survivors. A number of radiation research centers in the United States were visited to observe techniques being used in dosimetry studies currently in progress in the United States which could be applied to the study at ABCC in the future. A complete series of monthly reports, ten in number, is included. A protocol which describes the major portion of future work in dosimetry has been drawn up and approved for implementation in January 1966 - ABCC Research Protocol 3-66, Dosimetry, Diagnostic Medical x-ray; Based on Survey of ABCC Subjects and of Community Hospitals and Clinics, Hiroshima and Nagasaki. 31 references, 7 figures, 15 tables.

21071 **(ABCC-TR—1-67) Inventory of ABCC autopsies.** (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Jan 1967. Contract AC01-76EV03081. 88p. (In Japanese and English). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008100.

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The autopsy has been a major research tool at ABCC since 1948, when a Genetics Program was initiated with performance of autopsies of fetuses and infants in Hiroshima as part of that study of the influence of radiation on the outcome of pregnancy. In Nagasaki, autopsies were begun in 1949 under this same program, and extended to other programs in 1950. By 1953 approximately 1200 postmortem examinations had been made on stillborn and on newborn infants as part of the Genetics Program. Inasmuch as the genetic study has been completed and its results published, and the protocols filed separately, the autopsies performed under that program are not included in this inventory. Exposure to direct radiation from the atomic bomb is indicated in terms of distance from hypocenter at the time of the bombing (DIST), shielding situation (SHIELD), and acute radiation symptoms (SYMP). Although it is believed that the listed facts are essentially correct, they do not by themselves fully measure exposure to the radiation from the explosions. For the instantaneous, whole-body irradiation from the bombs an effective dosimetry has been evolved at ABCC largely on the basis of the experiments and advice of the Health Physics Division, Oak Ridge National Laboratory, supplemented in recent years by efforts of the National Institute of Radiological Sciences in Japan. The dose from induced or residual radiation remains unknown but is believed to have been small. The current, or T65D system, provides estimates of individual doses in terms of gamma radiation and neutrons separately, which are available to ABCC investigators working on specific research problems. 114 references.

21072 **(ABCC-TR—4-65) Survival in children of parents exposed to the atomic bomb: a cohort-type study.** Kato, Hiroo; Schull, W.J.; Neel, J.V. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 6 Dec 1965. Contract AC01-76EV03081. 36p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008112.

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A cohort-type study of children born subsequent to the atomic bombs of Hiroshima and Nagasaki and divisible into three groups on the basis of parental exposure (a heavily exposed, a lightly exposed, and a nonexposed group) has failed to disclose significant variation in mortality ascribable to differences in radiation. The average number of years at risk is 9, but varies from 3 to 15 years. Though the comparison groups differ significantly with respect to certain extraneous sources of variation in mortality, notably parental ages, and birth rank, the failure to observe significant mortality differences among the exposure groups is not attributable to the existence of this concomitant variation. In view of the number of years of death at risk, on the average, and the knowledge that the bulk of mortality prior to the 21st birthday is, in fact, prior to the 10th, it seems improbable that mortality prior to maturity can be shown to be a function of parental exposure in either Hiroshima or Nagasaki. This failure to demonstrate significant differences among the exposure groups does not necessarily imply that there are no differences. It merely means that within these years and numbers of observations no effect is to be seen. 27 references, 2 figures, 13 tables.

21073 **(ABCC-TR—4-66) Serologic response of atomic bomb survivors following Asian influenza vaccination.** Kanamitsu, Masatsugu; Morita, Katsuhiko; Finch, S.C.; Kato, Hiroo; Onishi, Shigeyuki. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 24 Mar 1966. Contract AC01-76EV03081. 17p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008113.

The effect of atomic bomb radiation on antibody production was studied among persons living in 1961 who were exposed while in utero to the atomic bomb in either Hiroshima or Nagasaki. They were inoculated with an Asian influenza virus vaccine. The relationship between the distance from the hypocenter at the time of the bomb and production of complement-fixing antibody to various types of influenza A virus was observed. The doctrine of original antigenic sin was applied to determine the effect. Patterns of the antibody levels in the group beyond 3000 m suggested that the virus of primary infection in the survivors was type A1. Significantly reduced A1 type serum antibody levels were noted in both pre- and postvaccination sera of the subjects within 2000 m from the hypocenter in Nagasaki. The effect of previous radiation exposure appeared much more clearly in heterotypic antibody following Asian influenza vaccination, that is, the antibody responses to type A1 viruses were almost completely suppressed in the subjects exposed within 1600 m both cities despite the fact that the antibody responses to type A viruses were similar to those in the group beyond 3000 m. In contrast, homotypic antibody response to Asian type virus was rather enhanced in the subjects within 1600 m. 23 references, 4 figures, 3 tables.

21074 **(ABCC-TR—5-65) Detection of leukemia and related disorders, Hiroshima and Nagasaki.** Finch, S.C.; Hrubec, Z.; Nefzger, M.D.; Hoshino, Takashi; Itoga, Takashi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 22 Jul 1965. Contract AC01-76EV03081. 19p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008114.

Broad features of the ABCC effort to identify and document cases of leukemia and certain closely related hematologic disease among survivors of the atomic bombs in Hiroshima and Nagasaki are set forth. Emphasis is given to the classification of certainty of diagnoses and to the ways in which accumulated case material can be utilized for research purposes, most specifically in the evaluation of incidence. The mechanics of case screening and processing are summarized, and the various files of case material in the Departments of Medicine and Statistics are described briefly. 17 references, 1 figure.

21075 **(ABCC-TR—8-65) Radiological practice and medical records in a large General Hospital in Hiroshima.** Matsuura, Keiichi; Sawada, Shozo; Russell, W.J.; Yoshinaga, Haruma. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 26 Aug 1965. Contract AC01-76EV03081. 19p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008127.

The analysis of the records of the Radiology Department of a large general hospital in Hiroshima is reported. This analysis demonstrated that: over the years since the end of World War II, the activity of radiologic practice in this hospital has gradually increased. This may apply to the entire community as well. This increase in activity was due mainly to radiography, fluoroscopy, and photofluorography, and not due to radiation therapy. Activity of radiation therapy in this hospital is not thought to be typical for the community as a whole. The analysis also demonstrated the usefulness which medical records and x-ray film data can serve - in this study - a supplement to a dosimetry program, by indicating the scale of radiologic practice. While film consumption is not a direct indicator of number of examinations performed or exposures incurred, it is a useful measure of activity for a Radiology Department when properly qualified. A brief review of the usefulness of well-kept records is presented. 15 references, 8 figures, 5 tables.

21076 **(ABCC-TR—9-66) Medical x-ray dosimetry in Hiroshima and Nagasaki.** Russell, W.J. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 15 May 1966. Contract AC01-76EV03081. 23p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008128.

This interim report describes briefly the scope and preliminary findings of a series of studies in medical x-ray dosimetry in Hiroshima and Nagasaki. Exposure of ABCC subjects to medical x-ray in other hospitals and clinics in the communities differs by city, either because of health programs or medical practice or both. Radiologic technique differs significantly by city and the activity of radiologic practices in both cities have increased markedly and steadily since 1945. Medical x-ray dosimetry at the Atomic Bomb Casualty Commission, Hiroshima and Nagasaki is designed to help estimate total exposure of A-bomb survivors to ionizing radiation supplementing knowledge of A-bomb dose. 21 references.

21077 **(ABCC-TR—11-64) Report on dosimetry problems and summary of a visit to US scientific establishments.** Yoshinaga, Haruma. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 23 Apr 1964. Contract AC01-76EV03081. 25p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008129.

This report contains a synopsis and itinerary for a visit to US institutions during 1964 in order to observe dosimetry studies in progress. Exposure to diagnostic x-ray is of special interest in determining total lifetime radiation doses for the survivors of the atomic explosions in Hiroshima and Nagasaki. (DMC)

21078 **(ABCC-TR—13-65) Further observations on sex ratio among infants born to survivors of the atomic bombs, Hiroshima and Nagasaki.** Schull, W.J.; Neel, J.V.; Hashizume, Asaji. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 18 Nov 1965. Contract AC01-76EV03081. 18p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008130.

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Data are presented on the sex ratio of 47,624 children born in Hiroshima and Nagasaki during 1956 to 1962. The total number of births in these two cities for which information is available is now 140,542, and of this number in 73,994 instances one or both parents were exposed to the atomic bombs. The suggestion of an effect of exposure on sex ratio in the earlier data is not borne out by the present findings. One can argue either that a small early effect has disappeared or that the original observation had no biological significance. 27 references, 4 tables.

21079 **(ABCC-TR—14-66) Urinary findings of children exposed in utero to the atomic bombs, Hiroshima and Nagasaki.** Freedman, L.R.; Keehn, R.J. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 9 Jun 1966. Contract AC01-76EV03081. 17p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008151.

Data from urinalyses at ages 9 to 16 were tabulated for children exposed to ionizing radiation in utero at the time of the atomic bombs in Hiroshima and Nagasaki in 1945 and for comparable control groups. Proteinuria was detected more often at various ages in boys in Hiroshima and girls in both cities whose mothers were within 1500 m of the bomb hypocenters. However, the differences were statistically significant only in girls ages 13 or 14. Casts were also seen more commonly in Hiroshima girls located at the same distance. Red and white blood cell excretion in the urine and glycosuria did not appear to be related to radiation exposure. Future investigations will be necessary to define the biological significance of these findings. 11 references, 8 tables.

21080 **(ABCC-TR—14-67) Gastric cancer in the ABCC-JNIH adult health study sample, Hiroshima-Nagasaki.** Johnson, K.G.; Archer, P.G.; Johnson, M.L.T.; Wanebo, C.K. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 10 Jul 1967. Contract AC01-76EV03081. 13p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008137.

This study attempted to identify items that are routinely recorded at physical examination which might be of predictive value concerning the subsequent development of gastric cancer. None of the clinical signs or laboratory results evaluated were found to be of predictive diagnostic value. Screening for gastric cancer to demonstrate achlorhydria or by upper gastrointestinal series would have been an impractical measure as has already been demonstrated in other larger case series. 5 references, 8 tables.

21081 **(ABCC-TR—16-63) Carcinogenesis in Hiroshima and Nagasaki. Observations from ABCC-JNIH pathology and statistical studies.** Zeldis, L.J.; Jablon, S.; Ishida, Morihiro. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1963. Contract AC01-76EV03081. 20p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008086.

Studies in Hiroshima and Nagasaki of a possible carcinogenic effect of radiation in survivors of the atomic bombings are included in programs conducted jointly by the Atomic Bomb Casualty Commission (ABCC) and the Japanese National Institute of Health (JNIH) with the collaboration of physicians and medical organizations in both cities. In order to cope with epidemiologic problems that attend these, in common with other studies of human populations, ABCC-JNIH programs are now oriented to the intensive surveillance of health, morbidity, and mortality principally in known, fixed cohorts of the survivors. The data reported here are derived from 3 interrelated programs in Hiroshima and Nagasaki: the JNIH-ABCC Life Span Study, Tumor Registry Studies, and Joint ABCC-JNIH Pathology Studies. The population samples utilized in these studies are defined along with summarizing pertinent information concerning their exposure to ionizing radiation.

21082 **(ABCC-TR—17-66) Spleen shielding in survivors of the atomic bomb.** Gregory, P.B.; Milton, R.C.; Johnson, M.L.T.; Taura, Tadashi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 7 Jun 1966. Contract AC01-76EV03081. 23p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008122.

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This paper reports the results of efforts to detect an influence of the spleen on the recovery of persons exposed to ionizing radiation in Hiroshima and Nagasaki. Included in this study are 291 such persons. The results indicate that Hiroshima survivors with scars who were under 30 years of age at the time of the bomb (ATB) and exposed within 1300 m from the hypocenter tolerated splenic irradiation poorly. In addition, splenic irradiation was accompanied by more frequent epilation and fever in survivors with scars over age 30 ATB. The conclusions drawn are based on the assumptions that the orientation of scarred survivors with respect to the hypocenter ATB was random, that distance from the hypocenter is a reliable index of exposure, that any shielding was either negligible or distributed uniformly among the scarred population and finally that any observed effects were actually due to an influence of the spleen. The sequential test generally supports the hypothesis of no dose-independent spleen shielding effect, and hints at the possiblity of a spleen shielding effect for high dose. However, due to the small number of observations and the apparently small difference (if any) between the true value of p and .75, the tests are regarded at best as merely suggestive. The 1300 m distance group, corresponding to a total air dose of about 90 rad, showed the largest difference from expected random behavior. If there is a real high dose effect it is unfortunate that the number of subjects in the 1200m group (total air dose greater than 150 rad) was too small to substantiate this fact. 20 references, 2 figures, 5 tables.

21083 **(ABCC-TR—17-67) Cytogenetics symposium at ABCC, 19-20 June 1967.** Awa, Akio A.; Bloom, A.D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 10 Jul 1967. Contract AC01-76EV03081. 13p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008123.

The Symposium held at Hiroshima ABCC reviewed with the invited Japanese geneticists and the ABCC staff the current status of the cytogenetics program. The results of the first study based on the ABCC-JNIH Adult Health Study sample indicated that heavily exposed survivors who were under 30 years of age at the time of the bombs still harbor chromosomal rearrangements in their peripheral leukocyte chromosomes. Data more recently obtained on exposed survivors who were over 30 years of age indicate a still higher proportion of aberrations in their circulating leukocytes, largely of the so-called stable type. The presence of what appeared to be distinct clones of cells with a specific chromosomal abnormality in each of four heavily exposed survivors suggests that some lymphocytes, or lymphocyte precursors, from the pool of immunologically competent cells do divide in vivo. The continued identification of subjects with residual aberrations may allow assessment at a future time of the effect of somatic mutations on the survivors in terms of the development of clinical disease, especially neoplastic disease. The major new study begun in the past year involves a cytogenetic approach to the F_1 generation. As discussed at the Symposium in considerable detail, the effect of ionizing radiation on the meiotic, or germ cell, chromosomers may be the induction of balanced chromosomal rearrangements which would be transmissible to clinically normal offspring. In order to detect an existing effect, several thousand children of exposed parents may need to be studied cytogenetically. It is likely that this study will require several years for completion. 8 references.

21084 **(ABCC-TR—19-66) Mail survey on cardiovascular disease study, Hiroshima and Nagasaki.** Kato, Hiroo; Johnson, K.G.; Yano, Kasuhiko. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 21 Jul 1966. Contract AC01-76EV03081. 32p. (In Janapese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008126.

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A mail survey was conducted on 13,000 males in the JNIH-ABCC Life Span Study population aged 40 to 69 in January 1965. The information sought was largely related to what are considered to be risk factors in the development of cerebral and cardiovascular diseases. The questionnaire included such items as residential history, occupation, physical activity, smoking, dietary custom, educational history, medical history, and family history. The final response rate was high (93%) after three mailings and supplemental field visits. As a preliminary analysis, the distribution of these variables was compared by city and exposure status. This analysis revealed that Hiroshima subjects were more educated, were more often managers, clerical workers, and sales workers, performed less physical activity, had more living space and ate a more Western type diet than Nagasaki subjects. It was also shown that the distribution of such variables as place of birth, present address, occupation, marital status, and education differed by the exposure status of subjects. Some methodological problems inherent in a mail survey such as completeness and reliability of obtained information were discussed. 15 references, 1 figure, 28 tables.

21085 **(ABCC-TR—19-67) Hemoglobin Hijiyama ($\alpha Z\beta_2$/sup 120 Glu/). A recently discovered fast-moving hemoglobin in a Japanese family.** Miyaji, Takaoki; Iuchi, Iwao; Oba, Yuso; Yamamoto, Kiyomi; Shibata, Susumu; Hamilton, H.B. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1 Sep 1967. Contract AC01-76EV03081. 14p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008140.

An abnormal hemoglobin found in two generations of a Japanese family residing in Hiroshima has been named Hb Hijiyama. The individuals with this variant are asymptomatic and have no abnormal hematologic findings. Hybridization test with canine hemoglobin and urea dissociation paper electrophoresis of the globin showed the abnormality to be in the β chain. Fingerprints were prepared of trypsin digested globin and of the β chain, both directly and after amino-ethylation. An abnormal peptide which appeared in the amino-ethylated fingerprint was extracted, hydrolyzed and analyzed for amino acid content. The 120th residue of the β chain of Hb Hijiyama, lysine, was replaced by glutamic acid. Thus, the notation for Hb Hijiyama, a newly discovered variant hemoglobin, is $\alpha_2\beta_2$/sup 120 Glu/.

21086 **(ABCC-TR—20-67) Chromosome aberrations in leukocytes of older survivors of the atomic bombs, Hiroshima and Nagasaki.** Bloom, A.D.; Neriishi, Shotaro; Awa, Akio A.; Honda, Takeo; Archer, P.G. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1 Sep 1967. Contract AC01-76EV03081. 12p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008141.

Seventy seven heavily exposed survivors of the atomic bombs, and 80 control individuals, were studied cytogenetically. All were over 30 year of age ATB. Complex aberrations were found in 61% of the heavily exposed survivors, and in 16% of the controls. The percentage of these abnormalities in cells of the exposed was 1.5, and in cells of the control group, 0.3. Translocations and pericentric inversions predominated, unlike the findings in the younger, previously studied survivors. In addition, what may be clones of translocations were noted in four heavily irradiated persons. 15 references, 1 figure, 2 tables.

21087 **(ABCC-TR—21-60) Study of mortality in children exposed in utero: research plan.** Ueda, Shoichi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Oct 1960. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008417.

A list of those born from the day of the A-bombing to 30 June 1946 will be prepared from the birth reports available in both cities and certain adjacent areas. Further definition of the study group will be deferred to a later stage. All of the birth reports will be investigated as to the exposure status of the mother, some socioeconomic index before and after the birth, and survival status. After investigating the present address using as a lead the address or honseki at the time of birth as stated in the birth report, an investigation will be made by a home visit or a questionnaire mailed to the subject. If the child or mother is already included in the clinical examination program, investigation will be made at the time of their visit to ABCC. A preliminary analysis will be conducted as to the completeness of the birth report. Then, a proper study group and its control group will be defined with consideration of socioeconomic factors. 7 references.

21088 **(ABCC-TR—22-66) Proteinuria in Hiroshima and Nagasaki atomic bomb survivors.** Freedman, L.R.; Seki, Masafumi; Phair, J.P.; Nefzger, M.D. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 25 Aug 1966. Contract AC01-76EV03081. 27p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008143.

A study of the epidemiology of proteinuria was conducted on about 5000 persons comprising a portion of the clinical sample under study at the Atomic Bomb Casualty Commission. In addition, data from previous examinations of similar samples were analyzed. Proteinuria was more common in Hiroshima than in Nagasaki. The rates for men and women did not differ within cities. Age-specific rates of proteinuria were peculiar, peaking in adolescence and old age. In the subjects under study proteinuria was frequently inconstant and usually represented excretion of less than 1.0 g of protein per day. Prior exposure to radiation as measured by distance from the hypocenter was correlated with increased proteinuria rates in 18-year-old subjects who were in utero ATB. Subjects exposed after birth did not show this tendency. It is unsettled whether radiation results in renal disease by increasing the subject's susceptibility to the usual causes of glomerulonephritis or by some more direct mechanism. Persons with proteinuria had higher mean blood pressures and serum urea nitrogen levels than controls and had other findings indicative of generalized cardiovascular-renal disease. Persons with thyroid disease had an increased risk of proteinuria whereas the converse was true of those with a history of treatment for peptic ulcer. Many other factors were tested for a relation to proteinuria, including family history of renal disease, socioeconomic status, urinary symptoms, ingestion of medications, physical findings, hemoglobin levels, height, weight, ABO blood groups, audiometry, vibrometry, and serum cholesterol levels. Although urinary symptoms were more common in persons with proteinuria, the findings in other areas were not sufficiently different to suggest meaningful relations. 20 references, 2 figures, 13 tables.

21089 **(ABCC-TR—23-66) Cerebral vascular disease in Hiroshima. Report of a six-year period of surveillance, 1958 to 1964.** Johnson, K.G.; Yano, Katsuhiko; Kato, Hiroo. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 25 Aug 1966. Contract AC01-76EV03081. 28p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008150.

Cerebral vascular disease (CVD) in the population of Hiroshima, Japan, is described for the period 1958 to 1964. The incidence of CVD in the male population over 30 years of age was 7.4 per 1000 per year and in females 4.1, approximately twice the observed incidence of coronary heart disease. Being based on examined individuals only, these estimates are biased downward, perhaps by a factor of 10%. The frequency of cerebral thrombosis was twice that of cerebral hemorrhage. These findings on incidence and type of CVD are in accord with the known high incidence of this disease in Japan but do not suggest that any disease other than atherosclerosis of the cerebral arteries is responsible. Hypertension, cardiomegaly (ascertained by ECG or chest film), and proteinuria were important factors in the risk of subsequent CVD. The singular association between hypertension and CVD, and the evidence that CVD is declining in Japan, the US and Europe during a period of widespread use of antihypertensive agents, encourage further epidemiologic study in CVD. 30 references, 15 figures, 8 tables.

21090 **(ABCC-TR—24-64) Retained thorium dioxide media in seminal vesiculography. A follow-up study with dose estimates.** Russell, W.J.; Hattori, Fumio; Morrow, L.B.; Yoshinaga, Haruma; Kogure, Takashi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Oct 1964. Contract AC01-76EV03081. 24p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008152.

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A brief review of the English and Japanese literature as to the past use of thorium dioxide-containing media is presented. Physical and laboratory findings including roentgenography in a follow-up study of 23 cases who received such contrast material for seminal vesiculography 12 to 14 years previously are also presented. Dose estimates were calculated for one patient typical of the entire group, and for another with a relatively larger residuum. Small amounts of retained contrast material were evident in all cases, but no case of neoplasia attributable to the presence of the media was detected. 29 references, 3 figures, 3 tables.

21091 **(ABCC-TR—25-64) Frequency of live births among survivors of the Atomic Bombs Hiroshima and Nagasaki.** Seigel, D.G. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 19 Nov 1964. Contract AC01-76EV03081. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008139.

Koseki data through 1961 were checked for the live birth experience of approximately 24,000 persons in Hiroshima and Nagasaki and comparisons made between groups at various distances from the atomic bomb in 1945. Among those with married status in 1945 the percentage with no births from 1945 to 1961 was the same

in each comparison group. This was also true for the subgroups with no births previous to 1945. Among those with first marriage from 1946 to 1950 the percentage with no births up to 1961 did not show any extraordinary variation by distance from the bomb; the same is true for persons with first marriage from 1951 to 1955. The ratio of live births to person-years of marriage during 1946 to 1961 was unrelated to comparison group. 10 references, 8 tables.

21092 **(ABCC-TR—26-60) Hematological findings for children exposed in utero - Hiroshima.** Takamura, Tsugiso; Ueda, Shoichi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1960. Contract AC01-76EV03081. 18p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008091.

For children irradiated in utero and nonirradiated children of Hiroshima hematologic findings between the years 1950 to 1957 have been compared, and no changes peculiar to the irradiated group were found. Despite several predisposing factors toward the development of iron deficiency in Japanese children, overt anemia was rare and distribution of hemoglobin levels was only slightly lower than reported for American and European children. Leukocyte levels, irrespective of age of the children, were found to be progressively falling in Hiroshima children so that by 1957 the values were distinctly lower than those reported for normal children in Japan and the United States. No cause for this change was apparent. 19 references, 7 figures, 3 tables.

21093 **(ABCC-TR—27-67) Examination of human diaphragms for trichinosis, Hiroshima and Nagasaki.** Gould, S.E.; Ozaki, Hiroyuki; Kimura, Kazuo. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 30 Nov 1961. Contract AC01-76EV03081. 9p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008116.

Trichinella spiralis has been found in three species of mammals born in Hokkaido so it possibly infects other species in Japan, including man. Although examination of human diaphragms in a small series of 149 autopsies in Hiroshima and 37 autopsies in Nagasaki (by digestion, compression, and microscopic sections) failed to reveal any instance of trichinous infection, it is felt that the existence or absence of human trichinosis inJapan can be determined only by examination covering a larger series of autopsies, and performed in various parts of the country. 6 references.

21094 **(ABCC-TR—28-64) Method for determining active bone marrow distribution.** Russell, W.J.; Yoshinaga, Haruma; Antoku, Shigetoshi; Mizuno, Masayoshi. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 17 Dec 1964. Contract AC01-76EV03081. 16p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008117.

This project was initiated to assess the contribution by medical x-ray to the cumulative ionizing radiation experienced by survivors of the atomic bombs. The study was conducted to define the quantity of active bone marrow irradiated in whole and partial body exposure in various roentgenographic, fluorographic and photofluorographic examinations, and in therapeutic procedures. Since the volume of tissue, including bone marrow, exposed in roentgenological examinations varies by body sites, by field size and configuration, calculations were made to determine the quantity of active marrow in such fields and body sites. An alternative would have been to make a gross estimate of the fraction or percentage of the total active marrow irradiated in a given procedure, without regard to specific location, depth or projection. A method is presented for calculating active bone marrow weights for body sites. Tables showing active marrow weight distribution by this method are included. The data thus compiled have application to calculation of bone marrow dose in standard diagnostic and therapeutic radiological procedures. 18 references, 2 figures, 3 tables.

21095 **(ABCC-TR—28-67) Clinical findings on in utero exposed microcephalic children.** Tabuchi, Akira; Hirai, Tsuyoshi; Nakagawa, Shigeru; Shimada, Katsunobu; Fujito, Junro. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 24 Dec 1966. Contract AC01-76EV03081. 24p. (In Japanese and English). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008118.

Portions are illegible in microfiche products.

Since animal experiments have shown that microcephaly is induced by fetal exposure to radiation and microcephaly has been found in children of mothers exposed to x-ray therapy during pregnancy (Murphy et al), the main cause of microcephaly in children exposed in utero to the A-bomb is considered to be ionizing radiation. Wood et al reported the increased incidence of microcephaly and mental retardation in children exposed in utero at proximal distances which they felt could not be attributed to any other known variable. ABCC has recently concluded that the effect of in utero exposure is primarily due to the immediate effect of radiation upon the fetuses although in A-bomb exposure the physical injury to the mother due to the A-bomb cannot be completely ignored. Our survey likewise revealed an increase of microcephaly in children exposed early in pregnancy at less than 15 weeks at closer distances than 1500 m. Thus, we presume that A-bomb radiation increases the incidence of microcephaly. 16 references, 8 tables.

21096 **(ABCC-TR—33-59) Report of ad hoc committee for appraisal of ABCC Program.** Francis, T. Jr.; Jablon, S.; Moore, F.E. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 6 Nov 1955. Contract AC01-76EV03081. 36p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008146.

The function of the Committee, according to its understanding, is to make an objective, scientific appraisal of the ABCC program as to its organization, plan of study, pattern of procedure, adequacy of data, caliber of performance, future outlook, and to report thereon with recommendations. It is apparent that the ABCC program had bogged down because of deficiencies in understanding of purpose, in ideas, in initiative, and in outlook. There has been a lack of investigative leadership and stimulating support. Significant observations have been made and, while gross evidence of radiation effects are not being detected at present, the data not yet analyzed may contain valuable information. If intimations of a shortening in life span should be substantiated, an impetus to investigations of underlying mechanisms will be provided. In any event, the continued imaginative investigation of the study population should yield knowledge of great value to medicine, to human biology, and to peaceful uses of atomic energy. It is believed that the program should be strengthened and given increased support. A unified plan of study is proposed. It should furnish more adequate data by coordination of effort, integration of information, and by maintaining analyses of data at a current level. It offers advantages to the stimulation and carrying out of research. Suggestions as to future plans of maintenance are briefly discussed.

21097 **(CONF-840512—3) Analysis of potential radiation-induced genetic and somatic effects to man from milling of uranium.** Momeni, M.H. (San Diego State Univ., CA (USA)). 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE83017940.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

Potential mortality from natural causes and from radiation exposure conditions typical of those in the vicinity of uranium mills in the western USA was calculated. The exposure conditions were those assumed to exist in the vicinity of a hypothetical model mill. Dose rates to organs at risk were calculated as a function of time using the Uranium Dispersion and Dosimetry Code (Momeni et al. 1979). The changes in population size, birth rates, and radiation-induced and natural mortalities were calculated using the PRIM code (Momeni 1983). The population of the region within a radius of 80 km from the model mill is projected to increase from 57 428 to 75 638.6 during the 85 years of this analysis. Within the same period, the average birth rates for five-year periods increase from 5067.8 to 7436.1. The cumulative deaths within the five-year periods increase from 724 and 3501.8 from spontaneously induced neoplasms and all causes, respectively, to 1538.2 and 6718.2. In comparison to natural causes, radiation-induced mortality is negligible. The highest rate of death from radiation in any five-year period is only 0.2, compared with 1538.2 deaths attributable to spontaneous incidence. The total radiation-induced genetic disorders were much less than unity for the 85-year period of analysis, in contrast with the 10.7% natural incidence of these disorders.

21098 **(DP-MS—84-29) Some medical aspects of radionuclide intakes.** Poda, G.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1983. Contract AC09-76SR00001. 16p. (CONF-830665—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010151.

From Health Physics Society summmer school on internal radiation dosimetry; Catonsville, MD, USA (12 Jun 1983).

In the field of medicine, particularly industrial medicine, the radiation aspect of the practice probably takes about 1/10 of 1% of our time. All the health physicist's tools of principles of internal dosimetry, lung models, mathematics, chemistry, etc. have little meaning until applied to an individual who has had an intake. This article discusses some of the medical aspects of internal dosimetry.

21099 **(HEDL—7365) Radiation protection technologist training and certification program.** (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1982. Contract AC06-70FF02170. 42p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84010256.

The purpose of this program is to establish training requirements and methods for certifying the technical competence of Radiation Protection Technologists. This manual delineates general requirements as well as academic training, on-the-job training, area of facility training, and examination or evaluation requirements for Radiation Protection Trainees (Trainees), Junior Radiation Protection Technologists (JRPT), Radiation Protection Technologists (RPT), and Senior Radiation Protection Technologists (SRPT). This document also includes recertification requirements for SRPTs. The appendices include training course outlines, on-the-job training outlines, and training certification record forms. (ACR)

21100 **(IAEA-R—2634-F) Influence of atmospheric emission from coal fuel cycle on the levels of natural radionuclides and heavy metals in the population. Final report for the period 10 July 1980-31 October 1982.** Jaworowski, Z. (International Atomic Energy Agency, Vienna (Austria)). Jul 1983. 167p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84700767.

From the determination of Ra, Pb, Zn and Cd concentrations in air and various human tissues of inhabitants exposed to large industrial emissions as well as of those of other regions it could be seen that geographical distribution of these elements is rather related to local natural background factors than to industrial activity in the region. The concentrations of ^{226}Ra and Pb increased during the last century in precipitations in Southern Poland, but in the same time they decreased dramatically in the bones of the Polish population. The contemporary Polish bones contain about 10 times less Pb and 2 times less ^{226}Ra than 11th to 19th century Polish bones and 18th century Peruvian bones. The decrease of ^{226}Ra content probably results from the introduction of drinking-water treatment systems which remove majority of ^{226}Ra and from decrease in consumption of cereals, which are principal sources of ^{226}Ra intake in the diet.

21101 **(IAEA-R—2742-F) Application of radiation for eliminating Salmonella and shelf-life extension of poultry and its products. Part of a coordinated programme on factors influencing the utilization of food irradiation process. Final report for the period 15 November 1980 - 14 February 1983.** El-Fouly, M.E.Z. (International Atomic Energy Agency, Vienna (Austria)). Sep 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700758.

A survey on the incidence of contamination of Salmonella in chicken put on sale in Cairo showed that from 559 samples investigated, 46% were found to be contaminated with Salmonella of 8 different serotypes, i.e., S. kottbus, S. sofia, S. typhimurium, S. zanzibar, S. muenchen, S. bovis-morbificans, S. ohio and S. enteritidis. The level of contamination was higher in summer and spring than in winter and autumn. Irradiation at 1.0 to 5.0 kGy resulted in marked suppression of all pathogenic microorganisms. The D_{10} values of different serotypes of Salmonella ranged from 0.26 to 0.40 in chilled chicken (4 deg. C) and from 0.53 to 1.09 in frozen chicken (-18 deg. C). S. ohio was the most resistant serotype in chilled and frozen samples while S. kottbus and S. sofia were the most radio-sensitive in chilled and frozen chickens, respectively. D_{10} values of S. aureus, E. coli and S. faecalis were 0.34, 0.30 and 0.95 kGy in chilled chicken and 0.51, 0.42 and 1.4 kGy in frozen chicken, respectively. Irradiation extends shelf-life of chilled chicken from 5 days for the unirradiated samples to 7, 13 and 25 days for samples treated with 1.0, 3.0 and 5.0 kGy, respectively. Irradiating chilled chicken with 5 kGy resulted in significant changes of odour immediately after the treatment. No difference was observed in frozen chicken treated with doses up to 5 kGy.

21102 (INS-NUMA—29, pp 130-134) **Studies on the spatial resolution of the biological effect of protons.** Arimoto, Takuro; Irie, Goro; Fujioka, Yasunori (Hokkaido Univ., Sapporo (Japan). School of Medicine); Hasegawa, Takeo; Takaku, Seisaku; Sugai, Isao. Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

Whether tissues adjacent to radiation volumes are indirectly affected were examined using a 52 MeV cyclotron. The proton beams had a diameter of 1 mm, and a dose rate of 1675 rad/min. The ratio of the Bragg peak to plateau was 3.3. The legs of mice were irradiated with protons at the dose of 10000 rad using mini beams in various sizes, with an observation period of 35 days. Biological effects such as epilation and malfunction of legs appeared between 8 and 12 days after irradiation with beams 1 - 9 mm in diameter. The degree of biological effects was apparently greater with increasing volume of irradiation.

21103 (NIRS-M—34, pp 286-297) **Biological approach, (1). Cell cycle synchronization and radiotherapy in the treatment of brain tumors.** Takakura, Kimitomo (Tokyo Univ. (Japan). Faculty of Medicine). 1981. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-791292—).

From 11. NIRS symposium of multidisciplinary therapy of cancer; Chiba, Japan (13 Dec 1979).

The effect of anticancer drugs on the cell cycle of in-vitro brain tumor cells is assessed. YM26 showed the greatest accumulation and synchronizing effect in the G2-M phase. In the in-vivo cell cycle of animal brain tumors, vincristine and ACNU accumulate and synchronize tumor cells in the G2-M phase, as in the in-vitro results. Clinically, tumor cells are accumulated with anticancer drugs in the highly radiosensitive G2-M phase. Radiotherapy in combination with these chemical compounds was given in 62 cases of malignant glioma and 19 of metastatic brain tumor. As a result, disappearance or marked regression of tumors on CT, accompanied by improvement of nervous symptoms, was observed in approx. 40%. Tumor regression on CT, or improvement of nervous symptoms was observed in 40%, but no effect was noted in 20%. The one-year survival rate was 78% and the two-year survival rate 38%. This method was much better than radiotherapy alone.

21104 (NIRS-M—35, pp 175-190) **Metabolism in the human body; kinetics of iodine metabolism and the effect of excess iodine. Distribution and metabolism of radioiodine in the human body.** Fukuda, Nobuo (National Inst. of Radiological Sciences, Chiba (Japan)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Distribution volume of extrathyroidal iodide as a function of the body weight and the time after injection of iodide was discussed by T.H. Oddie et al (1964). From study of iodide excretion under the block of thyroidal function, they found that the fecal excretion of iodide may be ignored compared to urinary one. Secondly, biochemical evidences on the iodide trapping, synthesis and release of thyroid hormones were reviewed. Active transport of iodide from blood is considered to be mediated by Na^+k^+-ATPase, and is stimulated by thyrotropic hormone (TSH). Trapped iodide is assumed to be activated by thyroperoxidase (TPO). Reaction of the activated iodine (I_2 or I^0) reacts with thyrosine radical of thyroglobulin (TG) and produces monoidothyrosine (MIT). Activated iodine also reacts with MIT and produces diiodotyrosine (DIT) enzymatically. Enzymatic coupling reaction of DIT with DIT or MIT produce thyroxine (T_4) or triiodothyronine, respectively. Iodinated thyroglobulin stored in thyroidal follice forms colloid droplet and is taken into epitherial cells by endocytosis. The colloid droplet fuses with lysosome and forms the phagosome. Organic

iodine compounds bound with TG is liberated by the protease mediated hydrolysis. Liberated thyroidal hormones (T_4, T_3) are released into blood, while the non-hormonal MIT and DIT are enzymatically deiodinated and resued for the hormone synthesis. Intravascular T_4 is enzymatically deiodinated and produces T_3. Thirdly, inhibitory effect of excess iodide on the thyroidal iodide uptake was briefly discussed. Next, 9-compartments model faithfully describing the biochemical pathway was solved by analog computer. Finally, theoretical expressions for the cumulative intra- or extra-thyroidal radioactivities as the functions of the concentration of extrathyroidal iodide were derived by solving the compartment model.

21105 (NIRS-M—35, pp 191-202) **Intake and excretion. Distribution and metabolism of radioiodine in the human body.** Uchiyama, Masafumi (National Inst. of Radiological Sciences, Chiba (Japan)). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Of radioiodine metabolism in man, the relations between intake, thyroidal uptake and excretion are explained. The internal radiation dose to the thyroid for public population is mainly given through the intake of contaminated food in all the ages. In the gestation, the fetus is exposed most to radioiodine immediately before delivery and the dose is estimated to amount a few times higher than the maternal thyroid. Importance of both the cow's milk and the breast milk as the sources of contaminant, is emphasized. Babyhood for 6 months after delivery, in this age the thyroidal exposure is estimated to be over 30 times for ^{131}I and about 9 times for ^{129}I as compared with that to the adult. Because of its long-term residence in the environment, ^{129}I is incorporated into cereals, leafy vegetables and meat besides milk. However, the critical age is still in the babyhood for 6 months after birth. Radioiodine given in a form of sodium iodide is actually completely absorbed in the intestines. However, the thyroidal uptake rate and the biological half-life are depresesed by administration of inorganic iodide. Radioiodine given in the form of sodium iodide is actually completely absorbed in the intestines. However, the thyroids uptake rate and the biological half-life are depressed by administration of inorganic iodide. Radioiodine both in the protein-binding fraction and in the total fraction of metabolised cow's milk, reaches the thyroid in the same manner as that given in a form of inorganic iodide. While, rats given radioiodine incorporated into seaweed, excreted tremendous amount of the nuclide into feces which resulted in very low uptake of the nuclide by the thyroid. To estimate population dose from radioiodine, the absorption rate of radioiodine may be one of the most important parameters.

21106 (NIRS-M—35, pp 203-229) **Deposition in the human thyroid gland. Distribution and metabolism of radioiodine in the human body.** Tanaka, Giichiro (National Inst. of Radiological Sciences, Nakaminato, Ibaraki (Japan). Nakaminato Lab. Branch Office). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Deposition of radioiodine in the thyroid gland of the Japanese has been described, especially on the following aspects of metabolic and radiological importance. 1) The measurements of radioiodine, essentially ^{131}I, in milk, thyroid glands of humans and cattle, and human urine are presented which were obtained at times following major Chinese nuclear tests. Highest observed ^{131}I concentration in cattle milk was ^{437}pCi per liter, and the transfer of ^{131}I in the environment to the thyroid gland was demonstrated. 2) Thyroidal uptake rate of radioiodine in the Japanese was estimated to be in a range 0.15 - 0.20 for f sub(w), lower than the reference value of 0.30 for the European and North Americans. The effect of stable isotope intake in the Japanese diet, estimated as 1.5 - 2.0 mg per day, which is one order of magnitude higher than the level in the latter populations, 0.2 mg per day, is demonstrated. This is based on uptake study data, obtained by the author et al. and also reported in the field of nuclear medicine. 3) Mass and dimensions of the thyroid gland in the Japanese male and female are described as a function of age and total body weight. The data reasonably assumed to be valid as reference values for the Japanese as of 1980s. 4) In vivo measurement of radioiodine in the human thyroid gland in case of any unplanned or accidental release of gaseous radionuclides from nuclear facilities is described using a Ge(Li) gamma spectrometry and also a scintillation surveymeter. The high-resolution gamma energy spectroscopy does not seem to be employed before for the present purpose.

21107 (NIRS-M—35, pp 161-171) **Studies on ^{129}I in bovine thyroid glands and investigations on revolatilization of iodine. Research carried out in Europe and U.S.A.** Glubrecht, H.; Kiselnic, L. (Hannover Univ. (Germany, F.R.). Inst. fuer Biophysik); Handl, J.; Kuehn, W. 1979. NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

In order to study fall out effect, deposition and revolatilization of iodine in the field and ^{129}I activity in bovine thyroid glands were studied. Deposition velocity of I_2 was 0.15 to 7 cm/sec, which was 100 times higher than that of CH_3I. Biological half-life of iodine was 7.5 +- 0.5 d. In the contaminated plants, indifferent to the environmental conditions. However, the decrease of iodine concentration was not observed when the plants were cut off immediately after deposition of iodine. A sample of soil with or without plants was contaminated with iodine and re-emitted iodine was trapped by a charcoal filter. Iodine concentration was determined by I-specific electrodes after 1, 2, 4, and 8 hrs. In any case, I_2 was re-emitted immediately after the contamination. Bovine thyroid glands were dried by deep freezing and ground after the addition of KOH. Organic compounds were decomposed by stepwise heating up to 600°C. Then iodine was extracted by concentrated H_2SO_4 and heated at 110°C. Evaporating iodine was adsorbed by a pure charcoal filter. By neutron activation analysis of the filter the activity of ^{129}I was 1.2 pCi/g iodine, which would be about 5 times higher than that measured in animals living far from nuclear installations. The distribution of stable iodine in thyroid gland was inhomogeneous.

21108 (NIRS-M—39, pp 89-106) **Binding of radionuclides to proteins in fish.** Suzuki, Yuzuru (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

Radioisotope tracer experiments on binding of radionuclides to proteins in fish were carried out in order to gain further information on biochemical behavior of radionuclides in marine fish. The radionuclides, which were bound to proteins in fish through sea water and food, were extracted with a Trisacetate buffer solution and separated by gel filtration on Sephadex G-75. Most of ^{137}Cs in the fish liver were bound only to a peptide with a molecular weight of 1,100 - 1,300. The most remarkable feature of ^{60}Co in the profiles of the gel filtration was the presence of two clear radioactivity peaks and the radioactivity appeared to transfer from a low molecular weight protein to a high molecular weight protein in the case of the uptake, and the reverse phenomenon was observed in the case of the excretion. Therefore, this suggested that these proteins had each inherent turnover rate for ^{60}Co. The profiles of the gel filtration of ^{65}Zn varied widely among species of fish, tissues or organs even in the same fish and pathways of the uptake. ^{125}I was bound to a relatively low molecular weight substance in cultured eel, however, the binding of ^{125}I to a protein with higher molecular weight was observed in the eel head including thyroid gland marked through food, and this protein was estimated to be thyroglobulin with molecular weight of 670,000. Although ^{95}Nb, ^{144}Ce-^{144}Pr and ^{106}Ru-^{106}Rh probably have no biological function in fish, it was apparently found to be organically bound in tissues or organs of the marine fish.

21109 (NIRS-M—39, pp 107-129) **Absorption and accumulation of some important radionuclides in fish from the digestive tract.** Kimura, Ken-ichi (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

It is well known that ^{60}Co, ^{54}Mn, ^{59}Fe, ^{65}Zn and ^{106}Ru are abundant radioisotopes released from nuclear power plant and nuclear fuel reprocessing plant. In order to obtain quantitative information on the efficiency of the transfer of the above-mentioned radio-nuclides from food organism to the predator, radioactive food was administered to a marine fish, acanthogobius flavimanus. It was found that the absorption rate of ^{54}Mn, ^{65}Zn and ^{59}Fe in the fish was considerably higher compared with the absorption rate of ^{106}Ru and ^{60}Co. From the daily feeding experiments, it is indicated that the accumulation of the radionuclides by the fish requires long period to reach an equilibrium state. Higher accumulation of ^{54}Mn, ^{65}Zn and ^{59}Fe in fish was also confirmed by the experimental results carried out by many investigators.

21110 (NIRS-M—39, pp 192-206) **Accumulation of cobalt by cephalopods.** Nakahara, Motokazu (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

Accumulation of cobalt by cephalopod mollusca was investigated by radiotracer experiments and elemental analysis. In the radiotracer experiments, Octopus vulgaris took up cobalt-60 from seawater fairly well and the concentration of the nuclide in whole body attained about 150 times the level of seawater at 25th day at 20°C. Among the tissues and organs measured, branchial heart which is the specific organ of cephalopods showed the highest affinity for the nuclide. The organ accumulated about 50% of the radioactivity in whole body in spite of its little mass as 0.2% of total body weight. On the other hand, more than 90% of the radioactivity taken up from food (soft parts of Gomphina melanaegis labelled with cobalt-60 previously in an aquarium) was accumulated in liver at 3rd day after the single administration and then the radioactivity in the liver seemed to be distributed to other organs and tissues. The characteristic elution profiles of cobalt-60 was observed for each of the organs and tissues in Sephadex gel-filtration experiment. It was confirmed by the gel-filtration that most of cobalt-60 in the branchial heart was combined with the constituents of low molecular weights. The average concentration of stable cobalt in muscle of several species of cephalopods was 5.3 +- 3.0 $\mu g/kg$ wet and it was almost comparable to the fish muscle. On the basis of soft parts, concentration of the nuclide closed association among bivalve, gastropod and cephalopod except squid that gave lower values than the others.

21111 (NIRS-M—39, pp 207-226) **High accumulation of cobalt-60 by the particular organ or part of some species in mollusca. Examination of the phenomenon in field condition and an estimation of the pathway of cobalt-60 in the open sea.** Yoshida, Katsuhiko (Ministry of Agriculture, Forestry and Fisheries (Japan). Tokai Regional Fisheries Research Lab.). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

A large amounts of samples in marine Cephalopoda and Tridacna were sampled in north west pacific ocean, near Japan. The samples were separated into organs or parts for determination of Co-60 concentration. A peculiar accumulation of Co-60 by the branchial heart of Octopus was also recognized in field condition, but it had become apparent that branchial heart of squid had not same ability. Liver of Cephalopoda had the ability to highly accumulate the Co-60 and specific activity of squid was one order highter than Octopus. The concentration of Cobalt-60 in visceral muss kidney of Tridacna maxima lineally increased with increasing shell length but that in other soft parts was kept constant. After examination of the other papers it was assumed that Co-60 highly accumulated in these organs was transfered by the food chain.

21112 (NIRS-M—39, pp 269-282) **Combining of some trace elements with constituent materials of marine algae.** Nakamura, Ryoichi (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

Two radionuclides (^{137}Cs and ^{106}Ru-^{106}Rh) were extracted from a brown alga (Eisenta bicyclis) into 5 solvents (Ethyl ethel, 80% Ethyl alcohol, boiled water, 0.2% NaOH and 24% KOH) in different proportions, suggesting that both radionuclides do not combine with fats and pigments, and that ^{137}Cs associates maybe with dextrans and monosaccharides, while, ^{106}Ru-^{106}Rh mainly combines with the cell wall polysaccharides such as alginic acid and fucoidan. In order to obtain information from extracts of algae, gel filtration was carried out on 2 species of algae (Ulva pertusa and Eisenia bicyclis) using Sephadex G-100 and G-25. Gel filtration profile gave only one peak for ^{137}Cs, 2 for ^{106}Ru-^{106}Rh and ^{125}I, and 3 for ^{60}Co corresponding to positions where saccharides of the algae appeared. As the result, it was found that different radionuclides combined with different constituent materials of an alga, to some extent. Gel filtration profiles of ^{125}I were compared with each other among several species of marine algae. They were different from one another among classes of green, brown and red algae, though they were similar in a class. Gel filtration profiles of ^{125}I were also varied between 2 chemical forms of ^{125}I ($Na^{125}I$ and $Na^{125}IO_3$).

21113 (NIRS-M—39, pp 139-146) **Accumulation and metabolism of radioactive nuclides. Fish.** Morita, Shigeki (Environmental Polution Research Center of Ibaraki-Ken, Mito (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

The distribution of ^{90}Sr and ^{137}Cs with a long effective half life showing relatively simple behaviors, into the fish was examined from the data of field work. ^{137}Cs tended to show higher coefficients of concentration in the order of shellfish, crustaceans and fishes in accordance with the food chain. If the concentration caused by the food chain was neglected, the biological half life was influenced by the body weight even among the same species of fish, and the coefficient of concentration showed differences due to growth and metabolic function. In comparison with stable Cs, the ^{137}Cs showed a coefficient of concentration 1.5 times that of ^{133}Cs in the fish muscle. With the exception of seaweeds, the distribution rate of ^{90}Sr was not so high, but its coefficient of concentration was higher than that of stable Sr in the fish muscle. However, the coefficient of concentration of stable Sr was higher in bones because of its slower metabolism.

21114 (NIRS-M—39, pp 229-233) **Accumulation and metabolism of radioactive nuclides. Molluscs.** Koyanagi, Taku (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

After the injection of RI into the mantle cavity of Iidako (Octopus ocellatus), changes of whole body radioactivity were examined. Both the inorganic and organic forms of cobalt were most heavily distributed in the branchial heart. Cyanocobalamin was distributed in an extremely small amount in the liver, but was more distributed in the arms, or gonad. Mn and Zn were almost equally distributed in most portions, but were scarcely accumulated in the branchial heart. Like Co, Fe was ubiquitous in the branchial heart. In relation to the gel filtration pattern of the branchial heart extract, Co-chloride mostly flowed out into the small molecular zone, and cyano-cobalamin into the heavy molecular zone. Mn, Zn and Fe flowed out into similar portions, and the outflux of protein in absorption spectrum was also similar. Only Co and Fe were concentrated in the branchial heart, suggesting not only that their forms of accumulation were similar, but also that Mn and Zn were present in similar forms.

21115 (NIRS-M—39, pp 320-335) **Choice of organ retention model for evaluating concentration factor and internal exposure dose.** Matsubara, Junko (Tokyo Univ. (Japan). Faculty of Medicine). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

There are problems in evaluating C.F. from chemical analysis data as well as isotopic equilibrium data obtained by tracer experiments when C.F. is utilized a parameter of internal exposure. The former method gives only static value obtained at a certain age of animals. Usually it is difficult to know detailed character of biological specimen analysed. Though with the latter method we can easily collect various information on experimental animals in vivo, it has another neck point. With some nuclides it is difficult to observe equilibrium between organisms and environmental water within a limited experimental period. The kinetic study says there are more patterns of which turnover of a nuclide between organism and surrounding does not obey one compartment model kinetics. The kinetics of some nuclides shows better fit to a power function model. This means the presence of the deposition mechanism into a certain organ, where C.F. should be theoretically of infinite value. It is recommended that we should take account of specific character of turnover of each element for varied biological factors and should know the broad range of estimating C.F..

21116 **(PNL-SA—10247) Epidemiologic studies of reproductive outcome in the Hanford Nuclear Workers Population.** Sever, L.E. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1982. Contract AC06-65RL01830. 6p. (CONF-8404118—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008305.

From Radiation epidemilogy contractors workshop; Rockville, MD, USA (13 Apr 1984).

A new study of birth defects and a study of reproductive outcome in a cohort of the worker population composed of the employees of the Hanford facility is described.

21117 **(SOU—1983-26) Irradiation of food. Report from a committee of experts.** Lindell, B.; Danielsson-Tham, M.L.; Hoel, C. (Jordbruksdepartementet, Stockholm (Sweden)). 1983. 148p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84700759.

A committee has on instructions from the Swedish government made an inquiry into the possible effects on health and working environment from irradition of food. In this report, a review is presented on the known positive and negative effects of food irradiation Costs, availabilty, shelf life and quality of irradiated food are also discussed. According to the report, the production of radiolysis products during irradiation is not easily evaluated. The health risks from irradiation of spices are estimated to be lower than the risks associated with the ethenoxid treatment presently used.

21118 (ZfI-Mitt—69, pp 307-312) **Radionuclides in the investigation of the cumulation of toxic elements on alga and fish.** Stary, J.; Zeman, A. (Czech. Technical Univ., Prague (Czechoslovakia). Dep. of Nuclear Chemistry); Havlik, B. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The present paper surveys the most important results obtained using $^{51}Cr(III)(VI)$, ^{65}Zn, $^{74}As(III)(V)$, $CH_3{}^{74}AsO(OH)_2$, $(CH_3)_2{}^{74}AsO(OH)$, $(CH_3)_3{}^{74}As$, ^{86}Rb, /sup 115m/Cd, ^{133}Ba, ^{137}Cs, $^{203}Hg(II)$, $CH_3{}^{203}HgCl$ and $C_6H_5{}^{203}HgCl$ for studying the cumulation, release and chemical transformation of the above species on alga and fish.

21119 (ZfI-Mitt—69, pp 395-407) **Experiments on sprouting inhibition in onions.** Dahlhelm, H.; Matejko, C.; Huebner, G. Jun 1983. NTIS (US Sales Only), PC A21/MF A01. (CONF-8209206—).

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The effect of ^{60}Co γ-irradiation on sprouting depends on the irradiation dose, on the irradiation time after harvest, and on the physiological development stage of onions. Experiments were carried out in order to study the physiological causes of sprout inhibition. The effect of the irradiation on cell elongation and cell division was investigated.

21120 **Radiation dose rates to the proximal humerus of growing beagles injected with ^{239}Pu.** Bruenger, F.W.; Smith, J.M.; Atherton, D.R.; Miller, S.C.; Jee, W.S.S.; Stevens, W. (Univ. of Utah, Salt Lake City). *Radiation Research;* **97**: No. 2, 302-317(Feb 1984). Contract AC02-76EV00119.

The anatomical distribution of ^{239}Pu in the proximal humerus was studied in four beagles injected at 90 days of age and sacrificed 7, 28, 56, and 128 days after injection, respectively. Initial deposition in each humerus was 3.1% of the injected Pu; 41% of that was retained with a net halftime of 248 days; for the remaining 59% no decrease was observed with time. Sixty-one percent of the initial deposit was concentrated in the proximal epiphysis and metaphysis. Average radiation dose rates to trabecular bone of the epiphysis, to those parts of the metaphysis that were formed before and/or after injection, and to the area corresponding to the primary and secondary spongiosa were determined by fission track autoradiography. Local dose rates within the range of 10 μm of the endosteal surface, to the marrow and to osseous tissue were calculated. The possible effects of local radiation doses were correlated with areal densities of cells and types of cells at risk. Comparisons were made with corresponding sites from the humerus of beagles injected as young adults.

21121 **Retention of plutonium in the beagle after gastrointestinal absorption.** Toohey, R.E.; Bhattacharyya, M.H.; Oldham, R.D.; Larsen, R.P.; Moretti, E.S. (Argonne National Lab., IL). *Radiation Research;* **97**: No. 2, 373-379(Feb 1984).

A 0.01 M bicarbonate solution containing 130 nCi (~5 kBq) of ^{237}Pu (90% hexavalent, 93% ultrafilterable) was administrated via gelatin capsule to six adult male beagles following a 21-hr fast. The dogs were sacrificed after 5-6 weeks and the percentage of the administered plutonium retained in the liver plus skeleton and its distribution within the skeleton were determined. The mean amount retained in these tissues was (0.063 +/- 0.006)% of the administered dose. The mean amounts of plutonium in the liver and the skeleton were approximately equal, and the distribution within the skeleton was similar to that observed by other workers following either intravenous injection or inhalation. Our value for plutonium retention by the dog is about a factor of three less than the values we have reported for rodents. It is a factor of 7 greater than the product of the values for gastrointestinal absorption (f_1) and fractional retention (f_2) recommended by the ICRP for man.

21122 **Computers and health physics.** Fisher, D.R.; Hadley, R.T. (Pacific Northwest Lab., Richland, WA). *Health Physics;* **46**: No. 1, 1-4(Jan 1984).

An editorial discussing the use of computer technology in health physics is presented. The nuclear age, the profession of health physics, and the computer grew up together. The computer has now become a most important tool for health physicists, greatly expanding our capabilities and permitting increasingly complex and rapid calculations involving large data sets. We have, in fact, become increasingly dependent upon computer systems for assisting with radiation measurements, performing shielding calculations, dosimetry, calculating health risks, and for maintaining records.

21123 **Radioactivity in cigarette smoke issue.** Cross, F.T. (Pacific Northwestern Lab., Richland, WA). *Health Physics;* **46**: No. 1, 205-208(Jan 1984).

The issue of radioactivity in tobacco smoke has received much attention in the scientific press in the past two decades and, increasingly, in the medical press. Martell and Sweder have recently reported that radon daughters naturally found in the environment are altered when they pass through burning cigarettes into mainstream smoke and are the ultimate cause of lung cancer in smokers. This note presents a dosimetric overview of the Martell

and Sweder paper as well as comments that have a bearing on radioactivity in cigarette smoke.

21124 **Measure of model reliability.** Williams, L.R. (Indiana Univ., South Bend); Leggett, R.W. *Health Physics;* **46**: No. 1, 85-95(Jan 1984). Contract W-7405-ENG-26.

A method for evaluating predictive models is developed by giving a precise and statistically meaningful interpretation to the statement that a model is accurate within a factor of k. This method is applicable to any model for which there is a set {y_1,...,y/ sub n/} of observations corresponding to a set {x_1,...,x/sub n/} of model predictions. We define a geometrically intuitive measure of model reliability k/sub g/ in terms of the ratios y/sub i//x/sub i/ and a statistically rigorous measure k/sub s/ in terms of ln (y/sub i//x/sub i/). For reasonably accurate models, k/sub g/ and k/sub s/ are in virtual agreement and thus can be used interchangeably as a reliability index. The index k/sub s/ estimates a model parameter of the form exp[(V_1 + V_2)^1/sup //^{2}], where V_1 describes an observational variance and V_2 is related to an uncertainty associated with the model itself. The computed value for k/sub s/ is not unique but depends on the sample of observations. The probability distribution of k/sub s/ can be characterized provided the observational distributions are lognormal, independent, and satisfy as homoscedasticity condition. These requirements are often satisfied by quantities of interest in radiation risk analyses.

21125 **Annual dose equivalents from varying annual intakes of ^{90}Sr.** Gant, K.S. (Oak Ridge National Lab., TN). *Health Physics;* **46**: No. 1, 211-213(Jan 1984). Contract W-7405-ENG-26.

The problem of determining the expected effects on a population exposed to both internal and external sources of radiation has two parts. First, the dose must be established, and then the effects can be estimated from the dose using one of the risk models. Most estimations of health impacts have dealt either with a single, large external exposure or intake, such as might result from an accident. The problem of estimating the effect of varying radiation doses over a period of years is seldom tackled when making a projection of the effects. In a recent study, the author found it necessary to evaluate the effects of external radiation exposures and varying intakes of ^{90}Sr for an arbitrarily chosen 20-year period. External exposures, proportional to the radiation levels in the environment, were readily available by year of occurrence, but because annual dose equivalents to various organs from ingested ^{90}Sr are dependent on past intakes due to the retention of the radioactive material in the body, they were more difficult to obtain. The author's procedures are outlined.

21126 **Biological effects of pion therapy beams: I. Cultured cells.** Raju, M.R. (Los Alamos National Lab., NM); Butler, J.L.B.; Carpenter, S.G.; Pierotti, D.; Smith, A.R.; Tokita, N. *International Journal of Radiation Oncology, Biology and Physics;* **9**: No. 1, 71-75(Jan 1983).

The results of cell killing by pion beams of different peak widths, ranges and sizes used in therapy are reported. Cultured hamster cells (V79) suspended in gelatin were used. The results indicate that: 1) there are no significant differences in cell-killing between pion beams of different ranges but of the same peak width; 2) there is a slight decrease in biological effectiveness with increasing peak width; and 3) the range-modulation functions used to produce uniform cell-killing are satisfactoy for intermediate-range pion beams, but slight corrections may be required for shorter- and longer-range pion beams.

21127 **Biological response across a ridge filter carbon ion Bragg peak.** Raju, M.R. (Los Alamos National Lab., NM); Carpenter, S.G.; Tokita, N.; Howard, J.; Lyman, J.T. *International Journal of Radiation Oncology, Biology and Physics;* **9**: No. 1, 67-70(Jan 1983).

The dose distribution of carbon ion beams was modified to cover 14 cm peak width using a ridge filter suitable for clinical application. The results of cell survival as a function of depth of penetration of carbon ions and the mouse skin (foot) response at the proximal-, mid-, and distal-peak positions using four daily fractions are reported. The objective of these studies is to verify whether the dose distribution in the peak region is properly compensated to produce uniform biological effect. The implications of the shape of the dose distribution in the peak region to radiotherapy application are discussed.

21128 **Radiobiology of pions at LAMPF.** Raju, M.R.; Tokita, N. (Los Alamos National Lab., NM). *International Journal of Radiation Oncology, Biology and Physics;* **8**: No. 12, 2133-2136(Dec 1982).

Recent radiobiology data for pion beams used in therapy are presented. The biological systems used were cultured cells suspended in gelatin and intestinal crypt assay. The importance of fast neutrons from pion stars in large treatment volumes is discussed. The data for compensating the depth dose distribution to produce uniform cell killing across the peak region are presented. The changes in biological effectiveness with peak width for pion beams (unlike heavy ions) are small because of fast neutron contribution from pion stars. The need for innovative radiobiology programs to guide high-LET radiotherapy is discussed.

21129 **Molecular and cellular radiobiology of heavy ions.** Tobias, C.A.; Blakely, E.A.; Alpen, E.L.; Castro, J.R.; Ainsworth, E.J.; Curtis, S.B.; Ngo, F.Q.H.; Rodriguez, A.; Roots, R.J.; Tenforde, T. (Lawrence Berkeley Lab., CA). *International Journal of Radiation Oncology, Biology and Physics;* **8**: No. 12, 2109-2120(Dec 1982). Contract AC03-76SF00098.

Quantitative studies at the BEVALAC have demonstrated some of the physical and radiobiological factors that promise to make accelerated heavy ions important for the therapy of cancer. The measured physical dose-biological effect relationships allow the safe and effective delivery of therapeutic schedules of heavy ions. Among the charged particle beams available, carbon, neon and helium ions in the "extended Bragg peak mode" have optimal physical and biological effectiveness for delivery of therapy to deep seated tumors. The depth-dose profiles of these beams protect intervening and adjacent tissues as well as tissues beyond the range of the particles. For the treatment of hypoxic tumors, silicon and argon beams are being considered because they significantly depress the radiobiological oxygen effect in the region of the extended Bragg ionization peak. The depth-effectiveness of the argon beam is somewhat limited, however, because of primary particle fragmentation. Silicon beams have a depth-dose profile which is intermediate between that of neon and argon, and are candidates to become the particle of choice for maximizing high LET particle effects. Heavy accelerated ions depress enzymatic repair mechanisms, decrease variations of radiosensitivity during the cell division cycle, cause greater than expected delays in cell division, and decrease the protective effects of neighboring cells in organized systems. Near the Bragg peak, enhancement of heavy particle effects are observed in split dose schedules. Late and carcinogenic effects are being studied. With the newly developed Repair-Misrepair theory we can quantitatively model most observations.

21130 **Pion radiotherapy at LAMPF.** Bush, S.E.; Smith, A.R.; Zink, S. (Univ. of New Mexico, Albuquerque). *International Journal of Radiation Oncology, Biology and Physics;* **8**: No. 12, 2181-2186(Dec 1982).

Clinical investigations of pi meson radiotherapy were conducted by the Cancer Research and Treatment Center of the University of New Mexico and the Los Alamos National Laboratory from 1974 until 1982. Two hundred and thirty patients have been treated for a variety of locally advanced primary and metastatic neoplasms. One hundred and ninety-six patients have been followed for a minimum of 18 months. Crude survival data range from 11% for unresectable pancreatic carcinoma to 82% for Stages C and D1 adenocarcinoma of the prostate. Acute tolerance of normal tissues is approximately 4500 pion rad in 36 fractions over 7 weeks. Severe chronic reactions have appeared with increasing frequency after doses in excess of 4000 pion rad.

21131 **Treatment of cancer with heavy charged particles.** Castro, J.R. (Lawrence Berkeley Lab., CA); Saunders, W.M.; Tobias, C.A.; Chen, G.T.Y.; Curtis, S.; Lyman, J.T.; Collier, J.M.; Pitluck, S.; Woodruff, K.A.; Blakely, E.A. . *International Journal of Radiation Oncology, Biology and Physics;* 8: No. 12, 2191-2198(Dec 1982). Contract W-7405-ENG-48.

A clinical radiotherapeutic trial using heavy charged particles in the treatment of human cancers has accrued over 400 patients since 1975, 378 of whom were treated with particles and 28 with low LET photons as control patients. Heavy charged particle radiotherapy offers the potential advantages of improved dose localization and/or enhanced biologic effect, depending on particle selected for treatment. Target sites have included selected head and neck tumors, ocular melanomata, malignant gliomata of the brain, carcinoma of the esophagus, carcinoma of the stomach, carcinoma of the pancreas, selected juxtaspinal tumors and other locally advanced, unresectable tumors. A Phase III prospective clinical trial has been started in carcinoma of the pancreas using helium ions. Phase I-II studies are underway with heavier particles such as carbon, neon and argon ions in order to prepare for prospective Phase III trials. Silicon ions are also under consideration for clinical trial. These studies are supported by the United States Department of Energy and National Institutes of Health.

21132 **In vivo radiobiology of heavy ions.** Phillips, T.L. (Univ. of California, San Francisco); Ross, G.Y.; Goldstein, L.S.; Ainsworth, J.; Alpen, E. *International Journal of Radiation Oncology, Biology and Physics;* 8: No. 12, 2121-2125(Dec 1982). Contract AC03-76SF01012.

The radiobiology of heavy charged particles has been investigated with various animal systems in vivo at the Lawrence Berkeley Laboratory using the helium beam from the 184" synchrocyclotron and the carbon, neon, and argon beams from the BEVALAC. Tumor experiments were carried out using the R_1 sarcoma in rats and the EMT6 mouse mammary carcinoma, comparing X rays, carbon ions, neon ions, and argon ions. In vivo normal tissue experiments have been carried out with a wide range of tissues including testis, bone marrow, intestinal crypt cells, lens of the eye, esophagus, lung, and the spinal cord. The induction of dominant lethal mutations after irradiation of the testis was assayed by in vitro embryo culture after in vivo irradiation. Experiments were also done with the Harderian gland tumor induction system.

21133 **Special proliferative sites are not needed for seeding and proliferation of transfused bone marrow cells in normal syngeneic mice.** Brecher, G. (Univ. of California, Berkeley); Ansell, J.D.; Micklem, H.S.; Tjio, J.H.; Cronkite, E.P. *Proceedings of the National Academy of Sciences of the United States of America;* 79: 5085-5087(Aug 1982). Contract W-7405-ENG-48.

The widely held view that transfused bone marrow cells will not proliferate in normal mice, not exposed to irradiation or other forms of bone marrow ablation, was reinvestigated. Forty million bone marrow cells from male donors were given to female recipients on each of 5 consecutive days, 5 to 10 times the number customarily used in the past. When the recipients were examined 2-13 weeks after the last transfusion, donor cells were found to average 16-25% of total marrow cells. Similar percentages of donor cells were found when variants of the enzyme phosphoglycerate kinase determined electrophoretically were used for identification of donor and recipient cells. Evidence is presented that the proportion of donor cells is compatible with a nonlinear dependence on the number of cells transfused over the range tested - i.e., 20-200 million bone marrow cells injected intravenously. Special proliferative sites thus do not appear to be required.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 19896, 20724, 21100, 21123

21134 **(LIS-Ber.—28) Damaged forest in the Federal Republic of Germany.** Prinz, B.; Krause, G.H.M.; Stratmann, H. (Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)). 1982. 154p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750724.

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The damage occurs, in the mainly stricken areas of Bavaria and Baden-Wuerttemberg, from altitudes of 800 m above sea level upwards and predominantly at the slopes showing to the west and south-west. A tendency towards a further extension of the damage area in direction of the more level tracts in the higher parts of the Black Forest and in the direction of ridges with their slopes showing east respectively north-east is unmistakable. The damage is characterized by the fact that within smallplots it is much differentiated with marginal trees along paths and clearings and particularly prominent ones in the middle of a batch being particularly effected. The syndrome can be detected in spruces and fir-trees of all age-groups including even the classes of young trees. As regards the species fir-tree, spruce, and beech-tree, the dark yellow discolouration of the assimilation organs is most striking. If later on turns into brown discolouration in the conifers, provoking premature loss of the needles. Beech-trees occasionally throw off, along with the yellow leaves, green ones, too. As regards fir-trees, spruces and beech-trees, the yellowing of the needles or leaves must be viewed as being associated with "air and light exposure". According to the findings reported in the literature, the fine root system of the trees is also affected and an alteration of the mycorrhiza seen. The damage symptoms are not comparable with the ones caused by SO_2, HF, HCl, NO_2, ozone or heavy metals (Zn, Pb, Cd). The damaged areas of wood exhibit a particularly rich growth of lichens. This is in absolute contradiction with earlier observations of lichens reacting to air pollutions like SO_2, HF and heavy metal with the utmost sensitivity.

21135 **(NP—4770179) Diseased forests and immission influences.** (Ministerium fuer Ernaehrung, Landwirtschaft, Umwelt und Forsten Baden-Wuerttemberg, Stuttgart (Germany, F.R.)). Apr 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770179.

Today, our forests are faced with a threat which has been unknown unitl recent years and whose dimension cannot be assessed and defined, yet. So-called 'forest mortality' has affected large forest areas in the Federal State of Baden-Wuerttemberg and continues to spread. Diseased leaved trees are reported more and more. If we do not succeed in damming up this wave of disease, there will be inestimable economic and ecological damage to be reckoned with. In its environmental research programme, Baden-Wuerttemberg has placed special emphasis with research into causes and possible counter-measures. According to the present state of scientific knowledge, air contaminants constitute the substantial cause of the disease. A leading part is played by sulphur dioxide, but also by nitrogen oxides, photo-oxidants, fluorine and heavy metals. Sulphur dioxide is discharged into the atmosphere mostly from the high chimneys of coal power plants and is apt to damage forests in far-away regions. Nitrogen oxides and photo-oxidants originate half in automobile traffic and half in firing installations of power plants and industries. Baden-Wuerttemberg, therefore, presses for a rapid and decisive reduction of the air's load of pollutants.

21136 **(NP—4770182) Lead and cadmium content of odontolith and teeth in inhabitants of a lead and zinc work district.** Sonntag-Dierks, L. (Muenchen Univ. (Germany, F.R.). Klinik fuer Zahn-, Mund- und Kieferkrankheiten). 4 Nov 1982. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770182.

The dissertation proposes to give a detailed report on the situation of the heavy-metal-exposed Goslar smeltering region. Four collectives from this smeltering region were investigated to elucidate the long-term and cumulative exposure of the population to

the heavy metals lead and cadmium. In industrial labourers and inhabitants from exposed and non-exposed areas odontolith was experimentally analyzed for its lead and cadmium content. The measurements showed that the lead content of milk-teeth in exposed areas is significantly above corresponding control values. Regarding the lead content of odontolith the investigation revealed that it is very significantly higher in industrial labourers and persons from exposed areas than the same values for persons from Goslar and Wolfsburg. The cadmium content of milk-teeth from exposed areas is significantly above the control values. Regarding the cadmium content of odontolith the values for the industrial labourers are significantly above the other values. A significant positive correlation between lead and cadmium contents was found for exposed, but not for unexposed groups of persons. This holds good for both milk-teeth and odontolith. The present values are compared with the data from investigations in Europe and the USA.

21137 **Correlation between spontaneous phenotypic changes in Pseudomonas strains with changes in the structure of catabolic plasmids: experiences with TOL plasmids.** Williams, P.A.; Cane, P.A.; Jeenes, D.J.; Pickup, R.W. (Univ. College of North Wales, England). pp 519-552 of Basic biology of new developments in biotechnology. Hollaender, A.; Laskin, A.I.; Rogers, P. New York, NY; Plenum Press (1983). (CONF-8205198—).

From Symposium on the biological basis of new developments in biotechnology; Minneapolis, MN, USA (25 May 1982).

This paper describes some of the phenotypic changes associated with plasmid-mediated catabolism which we have described in our laboratory over the past several years. All have been achieved by the selective pressure of growth of the host strains on particular carbon sources. Particulr reference is made to plasmids which confer the ability to metabolize naphthalene, toluene, xylenes, pesticides and aromatic acids. The instability of bacterial strains carrying these plasmid-borne genes is discussed.

5604 Other Environmental Pollutant Effects

21138 **(BNL—33239) 5.8 GHz ophthalmic microwave applicator for treatment of choroidal melanoma.** Finger, P.T.; Packer, S.; Svitra, P.; Paglione, R.W.; Albert, D.M.; Chess, J. (Brookhaven National Lab., Upton, NY (USA); RCA Labs., Princeton, NJ (USA). David Sarnoff Research Center; Massachusetts Eye and Ear Infirmary, Boston (USA). Howe Lab. of Ophthalmology). 1983. Contract AC02-76CH00016. 4p. (CONF-8306184—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007696.

From IEEE microwave symposium; Boston, MA, USA (1 Jun 1983).

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We report on the use of a 5.8 GHz microwave applicator to treat choroidal melanoma (Greene) in rabbits. The physical requirements needed to treat these intraocular tumors are quite different from those encountered elsewhere in the body. From a trans-scleral approach the penetration needed is minimal (5 to 10 mm.). The fibrous sclera is the only structure between the heat source and the tumor. The sclera has a relatively low water content when compared to tumor. This fact in addition to the frequency dependent interactions of tissue and electromagnetic radiation, results in an advantage to the use of the 5.8 GHz microwave device in treating intraocular malignancies.

21139 **Functional approach to the assessment of ocular hazards of low-power lasers.** Raybourn, M.S.; Kong, R.L. (Univ. of California, Berkeley). *Health Physics;* **46**: No. 1, 107-114(Jan 1984). Contract AC03-76SF00098.

An electrophysiological bioassay system has been developed to provide safety-related information about the functional consequences of non-thermal laser irradiation of the vertebrate retina. This in vitro preparation allows precise dosimetry at the retinal surface, provides for an intra-retinal control, comparing lased vs non-lased tissue, and permits quantitative assessment of the biophysical mechanisms of laser-induced retinal dysfunction.

57 HEALTH AND SAFETY

21140 **(JAERI-M—82-215) Comparative study: top event unavailability by point estimates and uncertainty propagation.** Watanabe, Norio; Ishigami, Tsutomu; Hikawa, Michihiro; Horii, Hideo; Tobioka, Toshiaki. (Japan Atomic Energy Research Inst., Tokyo). Jan 1983. 111p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700765.

The results of five cases studied are presented to identify how close the cumulative value represented by the point estimate is to the corresponding statistics of the top event distribution. The computer code FTA-J is used for quantification of the fault trees studied, top event unavailabilities, moments and cumulative probability distributions inclusive. The FTA-J demonstrates its usefulness for large trees. In all cases, the point estimate unavailability of the top event based on the median values of the basic events, which has been widely and commonly used in risk assessment for the sake of its simplicity, are lower than its median unavailability by uncertainty propagation. The top event unavailability thus obtained can represent much lower values: i.e. the system would appear much better than it actually is. The point estimate based on the mean values, however, is shown the same as that obtained by uncertainty propagation numerically and analytically. The mean of the top event can be well approximated by forming the product of the means of the components in each cut set, then summing these products. The point estimate can not represent all of the probability distribution characteristics of the top event, so that the estimation of probability intervals for the top event unavailability should be made either by a Monte Carlo simulation or other analytical method. When it is forced to calculate the top event unavailability only by the point estimate, it is the mean value of the component failure data that should be used for its quantification.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 19747, 19770, 19781, 19782, 20824, 20825, 20826, 20827, 20828, 21157

21141 (IAEA-TECDOC—291, pp 7-16) **Single well techniques.** Drost, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

The single well technique method includes measurement of parameters of groundwater flow in saturated rock. For determination of filtration velocity the dilution of radioactive tracer is measured, for direction logging the collimeter is rotated in the probe linked with the compass. The limiting factor for measurement of high filtration velocities is the occurrence of turbulent flow. The single well technique is used in civil engineering projects, water works and subsurface drainage of liquid waste from disposal sites. The radioactive tracer method for logging the vertical fluid movement in bore-holes is broadly used in groundwater survey and exploitation.

21142 (IAEA-TECDOC—291, pp 17-46) **Single well techniques using radioactive tracers.** Plata Bedmar, A. (Gabinete de Aplicaciones de la Energia Nuclear a las Obras Publicas, Madrid (Spain)). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

This work contains a slight revision of the techniques used up to now in the investigation of groundwater flows, through tests with radioactive tracers done inside a single well. The possibilities offered by the different techniques are described, as much in the case of granular as in consolidated media. The limitations arising from the most common experimental conditions and practical difficulties are both mentioned. The fields of application of greatest im-

portance are also related. At the end, a description of the tests done in fifteen wells is included; this represents different flow patterns, which have been chosen from more than 3500 wells studied by the author.

21143 (IAEA-TECDOC—291, pp 47-66) **Use of radioactive tracers in studies on infiltration through unsaturated zone.** Rao, S.M. (Bhabha Atomic Research Centre, Bombay (India). Isotope Div.). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

Artificial tritium parallel with other radioactive tracers have been used for determination of the rate of infiltration through unsaturated zone. Theoretical approach is followed by experimental data from field applications.

21144 (IAEA-TECDOC—291, pp 67-112) **Models for tracer flow.** Zuber, A. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

A review and discussion is given of mathematical models used for interpretation of tracer experiments in hydrology. For dispersion model, different initial and boundary conditions are related to different injection and detection modes. Examples of applications of various models are described and commented.

21145 (IAEA-TECDOC—291, pp 113-122) **Mathematical models in surface water flow, dispersion and quality studies.** Kuoppamaeki, R. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

Mathematical simulation models for flow field in the case of surface water are discussed. Due to the complexity of geometry the exact analytical solution of the flow field must be replaced by the numerical solution of the finite difference equations. A qualitative verification of the main characteristics of the computed flow field has been made by radioactive tracer experiments. The application of the model is for studies of transport and mixing of wastes released to the surface water system.

21146 (IAEA-TECDOC—291, pp 131-156) **Concentration dynamics in lakes and reservoirs. Studies using radioactive tracers.** Gilath, Ch. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

The use of radioactive tracers for the investigation of concentration dynamics of inert soluble matter in lakes and reservoirs is reviewed. Shallow and deep stratified lakes are considered. The mechanism of mixing in lakes, flow pattern and input - output response are discussed. The methodology of the use of radioactive tracers for concentration dynamic studies is described. Examples of various investigations are reviewed. The dynamics of shallow lakes can be found and expressed in terms of transfer functions, axial dispersion models, residence time distributions and sometimes only semiquantitative information about the flow pattern. The dynamics of deep, stratified lakes is more complex and difficult to investigate with tracers. Flow pattern, horizontal and vertical eddy diffusivities, mass transfer between the hypolimnion and epilimnion are tools used for describing this dynamics.

21147 (IAEA-TECDOC—291, pp 157-163) **Radioisotopes for the estimation of the water balance of lakes and reservoirs.** Payne, B.R. (International Atomic Energy Agency, Vienna (Austria). Div. of Research and Isotopes). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

The water balance of Lake Chala, on the borders of Kenya and Tanzania, was estimated by labelling the lake in 1964 with tritium. On the basis of measurements up to 1968 the estimated average annual subsurface inflow and outflow were 12.83×10^6 m^3 and 8.57×10^6 m^3 respectively. An additional sampling in September 1977 resulted in the revised estimates of 8.39×10^6 m^3 and 4.14×10^6 m^3 for the inflow and outflow respectively as average annual values during the period 1964 to 1977.

21148 (IAEA-TECDOC—291, pp 165-172) **Groundwater flow in karstic aquifers.** Zojer, H. (Research Centre, Institute for Geothermics and Hydrogeology, Graz (Austria)). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

Isotope methods for studying water flow in karstic systems use natural (environmental) tracers and artificial tracers. A short review on the use of radiotracers is given followed by description of several case studies.

21149 (IAEA-TECDOC—291, pp 173-185) **Comparison of radioactive and non-radioactive tracers.** Behrens, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie). Jul 1983. NTIS (US Sales Only), PC A09/MF A01. (CONF-8209207—).

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

The choice of tracers for studying groundwater flow is made between radioactive tracers, fluorescent dye tracers and chemical tracers. Determining factors for the tracer behaviour in the environment is its chemical constitution and stability. Factors influencing the tracer stability are discussed and conclusions on the choice of proper tracer for individual cases are drawn.

21150 **(USGS-OFR—83-535) Vegetation and climates of the last 45,000 years in the vicinity of the Nevada Test Site, south-central Nevada.** Spaulding, W.G. (Washington Univ., Seattle (USA)). 1983. Contract AI08-78ET44802. 210p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84009032.

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A site in or near the Nevada Test Site in south-central Nevada is being evaluated as a permanent repository for both transuranic-contaminated and high-level radioactive wastes. This study characterizes long-term climatic variability inherent to this area. Specifically, paleoenvironmental and paleoclimatic reconstructions spanning the last 45,000 years are offered to facilitate calculations of potential variations in water-table levels and ground-water recharge. Radiocarbon-dated plant macrofossil assemblages from ancient packrat (Neotoma spp.) middens in the Nevada Test Site and vicinity provide data for these paleoclimatic reconstructions. The uniformitarian assumption is made that climates of the last 45,000 years approximate the climates that will occur in the next 100,000 years. 132 references, 25 figures, 25 tables.

21151 **(USGS-OFR—83-855) Geohydrologic data for test well UE-25b No. 1, Nevada Test Site, Nye County, Nevada.** Lobmeyer, D.H.; Whitfield, M.S. Jr.; Lahoud, R.G.; Bruckheimer, L. (Geological Survey, Denver, CO (USA); Fenix and Scisson, Inc., Mercury, NV (USA)). 1983. Contract AI08-78ET44802. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009090.

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This report presents data collected to determine the hydraulic characteristics of rocks penetrated in test well UE-25b No. 1. This well is one of a series of test wells drilled in and near the southwestern part of the Nevada Test Site in a program conducted in cooperation with the US Department of Energy. These investigations are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for storage of high-level radioactive wastes. Data on drilling operations, lithology, core analyses, borehole geophysics, hydrologic monitoring, hydraulic testing, and ground-water chemistry for test well UE-25b No. 1 are contained in this report. 4 references, 28 figures, 5 tables.

5802 Geophysics

REFER ALSO TO CITATION(S) 19737, 20588, 20698

21152 **(UCRL—15594) Strong ground motion studies for South Carolina earthquakes. Final report.** Nuttli, O.W.; Rodriguez, R.; Herrmann, R.B. (Lawrence Livermore National Lab., CA (USA)). 30 Nov 1983. Contract W-7405-ENG-48. 106p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84009530.

The strong ground motion that will result from damaging earthquakes that occur in South Carolina, varying in size from those that can produce only minor damage to those as large as the 1886 event, was estimated. The report is divided into three parts. Part I discusses acceleration, velocity and displacement modeling, using available observational data (accelerograms and non-strong motion seismographic) and response spectra obtained from those data. Part II uses MM intensity data for estimating strong ground motion. Part III presents surface-wave focal mechanism studies of South Carolina earthquakes.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 19784, 19787, 19808, 19809, 19810, 19965

21153 **(SAND—82-1971C) Fragmentation under impulsive stress loading.** Grady, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 10p. (CONF-840579—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006341.

From SESA spring meeting; Cleveland, OH, USA (15 May 1984).

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The fracture properties of brittle materials subjected to impulsive or high rate loading are considered. Fracture is viewed as a microstructural process through the activation, growth and coalescence of a system of interacting cracks. The loading rate dependence of fracture stress is explained in terms of inertia of isolated cracks. The number of cracks participating in the fracture process and the number and size of fragments in the failed material are related to both the inherent flaw structure and the rate of energy application required to sustain the system of growing cracks. Lastly, continuum modelling of dynamic fracture focused toward computational analyses of complex applied problems is covered.

21154 **22nd US symposium on rock mechanics: rock mechanics from research to application.** Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). 553ppp. (CONF-810624—). Massachusetts Inst. of Tech., Cambridge, MA 02139.

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

This volume consists of paper from the 22nd U.S. Symposium on Rock Mechanics held at MIT, June 29-July 2, 1981. Central topics represented are: 1)heat and fluid flow, 2) fragmentation and fracture propagation, 3) rock mass deformation and 4) site characterization. Separate abstracts have been prepared for 23 papers having application to resource extraction, energy storage, nuclear waste disposal or energy production.

21155 **New approaches to problems of fluid flow in fractured rock masses.** Witherspoon, P.A.; Tsang, Y.W.; Long, J.C.S.; Noorishad, J. (Univ. of California, Berkeley). pp 3-17 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—). Contract W-7405-ENG-48.

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

An extension of Biot's theory of consolidation is proposed here to provide a new technique for a realistic method of investigating the thermal-hydraulic-mechanical behavior of fractured porous media. A direct solution process has been developed that involves a variational formulation and a Galerkin integral to produce a set of three matrix equations. In this approach the equations of static equilibrium and fluid flow appear in an implicitly coupled form and the energy equation is explicitly coupled to these equations. Finite element descretization, along with two schemes for time descretization, yield the final form of the matrix equations which are then solved in a two-step procedure, referred to as an interlacing scheme. A partial validation of this new technique is presented by considering applications to hydromechanical, thermomechanical, and hydrothermal problems.

21156 **Fully coupled thermal-hydraulic-mechanical model for non-linear geologic systems.** Hart, R.D. (Univ. of Minnesota, Minneapolis); St. John, C.M. pp 96-110 of 22nd US symposium on rock mechanics: rock mechanics from research to application. Einstein, H.H.; Scandariato, D.P. (eds.). Cambridge, MA; Massachusetts Inst. of Tech. (1981). (CONF-810624—). Contract W-7405-ENG-36.

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

Geo-engineering analysis frequently calls for prediction of the stresses, temperatures and water pressure distribution in soil or rock masses. Typically, such analysis is performed in a completely independent manner for each of the three phenomena involved; perhaps with the temperature field being used to determine thermal stresses and the water pressure being used to calculate the effective stress field. Such an approach may be justified on the basis that the behavior of the system is sensibly linear over the range of anticipate behavior or that the constitutive equations that define the coupled behavior of the system are inadequately determined to support a more thorough analysis. For some classes of problems, however, the couplings between the various phenomena require investigation, at least to the extent necessary to determine the sensitivity of the solution to constitutive assumptions made. Several interactions between phenomenal involved in fluid flow, heat transfer and mechanical deformation are identified. This paper briefly reviews development of constitutive equations that may be used to define the interactions and outlines a method for implementing these equations in a numerical procedure used for simulating the behavior or rock or soil systems. Finally, results for several model studies completed using part of all of the constitutive model are quoted.

5804 Geochemistry

REFER ALSO TO CITATION(S) 19754, 20833

21157 (CONF-8308106—, pp 726-736) **Relationship between precipitation and vadose-zone chemistry in a high-altitude watershed in Colorado.** Classen, H.C. (Geological Survey, Lakewood, CO); Reddy, M.M.; White, A.F. 1983. NTIS, PC A99/MF A01.

From 5. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Modeling reactions of water passing through the vadose zone prior to phreatic recharge requires knowledge of the prevailing chemical and physical conditions at the time of recharge. These conditions, therefore, directly affect subsequent reactions with waste placed in the vadose zone. Undisturbed areas provide a medium for development and testing of suitable reaction-model hypotheses. In the mountain watershed studied, precipitation components, which ordinarily are modeled as conservative, are dramatically affected by sublimation of winter snowpack. Concentration of components contributed by solution of minerals present in the vadose zone is affected by concentration of reactive components in precipitation, by hydrolysis of soil gas (primarily carbon dioxide), as well as by the relative reactivities of the solid mineral phases present. For snowmelt recharged mainly through fractured rock, soil gas hydrolysis contributes about 90 percent of the reactant; augite and plagioclase feldspar are the dominant reacting minerals. 12 references, 3 tables.

21158 (NIRS-M—39, pp 1-14) **Behaviors and chemical forms of radionuclides in seawater.** Honda, Yoshihide (Kinki Univ., Higashi-Osaka, Osaka (Japan). Faculty of Science and Technology). 1981. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. (CONF-8011205—).

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

Although the radionuclides introduced into the marine environment from various sources and routes are finally distributed among the components of the marine ecosystem, the residence time is one of the most useful measures of the reactivity of an element in the oceanic chemical system. Heavy metals such as Mn, Fe, Co and Zn which have shorter residence times, reveal more complicated behaviours in relation to marine radioecological interest than alkaline earth element such as Sr which has a longer residence time. The possible physico-chemical forms of radionuclides in the oceans are usually classified into three categories, that is, species in true solution, colloidal species, and particulate forms. The modeling to study the dispersion of radionuclides introduced into the marine environment can be approached with the aid of the knowledge of behaviors of their stable counterparts in seawater. The different physico-chemical forms between stable and radioactive nuclides in seawater may cause different biological concentration of the element. To realize the chemical speciation of radionuclides in the marine environment, it is also important in thermodynamical calculation to consider heterogeneous interfaces where cause raising the concentration of reactants in seawater, especially in the coastal waters. In the discussion on the primary factors that can affect the elemental distribution in the marine environment, primary productivity and bacterial activity are emphasized for the transformation of physico-chemical states of radionuclides in the marine environment. Finally, the radioecological differences between radiocobalt in organic complexed and ionic forms were demonstrated in the experiments on the uptake and elimination of radiocobalt by mussels.

5805 Oceanography

21159 (DOE/EV/00902—35) Continental shelf processes affecting the oceanography of the South Atlantic Bight. Progress report, June 1982-December 1983. Pietrafesa, L.J. (comp.). (North Carolina State Univ., Raleigh (USA)). Dec 1983. Contract AS09-76EV00902. 392p. NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE84010113.

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This is a report on the progress of continental margin oceanographic studies being conducted as a part of the overall DOE South Atlantic Bight program. The NCSU-DOE program is working towards a fundamental understanding of oceanographic processes which determine the transport pathways, residence times and ultimate fate of biological and chemical parameters in the coastal environment. Additionally, the SAB has been considered a potential area for fuel producing facilities and activities, as a medium for fuel transport and as a fuel waste receptacle. In that regard, impact upon the environment and environmental impact upon the activity can only be addressed with a more thorough assessment of the environment itself. Research activities have been directed toward the development of the bottom mounted tripod multiple input sensor system, toward the continuing analyses of South Atlantic Bight (Gabex I, Carolina Capes and Gabex II) current meter and ancillary data sets and toward the development of conceptual and theoretical models of continental margin processes and effects.

64 PHYSICS. I.

REFER ALSO TO CITATION(S) 21270

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 21251

21160 (AD-A—134318/5) Acceleration and confinement of energetic particles in the 7 June 1980 solar flare. Technical report. Kane, S.R.; Kai, K.; Kosugi, T.; Enome, S.; Landecker, P.B. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 31 Aug 1983. 42p. (TR—0083(3940-01)-2). NTIS, PC A03/MF A01.

Pulsations with large amplitude and duration have been observed during the hard X-ray and microwave radio bursts associated with the 7 June 1980 (approx. 0312 UT) solar flare. The high time resolution measurements of 20-800 keV X-rays were made with the X-ray spectrometers aboard the ISEE-3 and P78-1 spacecraft. The radio measurements, covering metric to microwave wavelengths, were made at the Nobeyama and Toyokawa observatories in Japan. The temporal evolution of the X-ray and radio spectra and the polarization and spatial structure of the microwave source have been examined. The following interpretation is found to be consistent with the observations: (1) the variations in the electron acceleration/injection spectrum are responsible for the observed variations in the hard X-ray and microwave emissions; (2) the locations of the hard X-ray and microwave sources are probably different, the X-ray source being located at a lower altitude.

21161 (CBPF-MO—003/82) Topics in Nuclear Astrophysics. Chung, K.C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 41p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701052.

Some topics in nuclear astrophysics are discussed, e.g.: highly evolved stellar cores, stellar evolution (through the temperature analysis of stellar surface), nucleosynthesis and finally the solar neutrino problem.

21162 (CBPF-NF—014/83) Weyl integrable space time: a model of our cosmos. Novello, M.; Heintzmann, H. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701056.

A Weyl Integrable Space Time as a consequence of a dynamical process is introduced. The particular case of a vector field non minimally coupled to gravity is studied. The consequences for cosmology are considered. It is found that it is possible to connect one Riemannian Space-time with another Riemannian space time by a series of Weyl integrable manifold.

21163 (CBPF-NF—019/83) Non-linear photons in the universe. 2. The anisotropic case. Novello, M.; Salim, J.M.; Ruckert, E. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700991.

The consequences of non-minimal coupling of electromagnetic and gravitational fields are examined. An exact solution is presented, which corresponds to a generalization of the anisotropic universe of Kasner and which can be interpreted as a previous era of an isotropic (photon dominated) Friedmann like universe.

21164 (CBPF-NF—026/82) Geodesic motion and confinement in Goedel's universe. Novello, M.; Soares, I.D.; Tiomno, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700992.

A complete study of geodesic motion in Goedel's universe, using the method of the Effective Potential is presented. It then emerges a clear physical picture of free motion and its stability in this universe. Geodesics of a large class have finite intervals in which the particle moves back in time ($dt/ds<0$) without violation of causality. Goedel's geometry produces the important property of confinement for a large class of geodesics. This property to discuss the construction of a gravitational container is used. This structure is highly stable, since there is no singularity in its interior, and independent of the energy of the particles contained in it.

21165 (CBPF-NF—045/82) Decrease of the solar flare/solar wind flux ratio in the past several aeons from solar neon and tracks in lunar soil plagioclases. Wieler, R.; Etique, Ph.; Signer, P.; Poupeau, G. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Aug 1982. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701062.

The He, Ne, and Ar concentrations and isotopic compositions of mineral separates of six lunar subsurface samples and of two regolith breccias which were exposed to the sun as early as 2 - 3 billion years ago are determined. The results are compared with our noble gas data obtained previously on mineral separates of lunar surface soil samples most of which contain recently implanted

solar gases. The mean solar flare track densities were determined on aliquots of several of the plagioclase separates analyzed for noble gases. Solar wind retentive mafic minerals and ilmenites show that a possible secular increase of the $^{20}Ne/^{22}Ne$ ratio in the solar wind during the last 2 - 3 Ga. is $< 2\%$. In plagioclases, which are less retentitve for solar wind Ne, a considerable fraction of the retained Ne is of solar flare origin. The data are compatible with values for $^{20}Ne/^{22}Ne$ of approximately 11.3 - 11.8, reported for solar flare Ne retained in plagioclase separates from lunar soils. The solar flare track data and the Ne data independently show that plagioclases exposed to the sun over the last 10^8 years recorded a lower mean ratio of solar flare to solar wind intensities than samples exposed about 1 - 3 billion years ago. On the basis of track data these ratios are estimated to differ by a factor approximately 2.

21166 **(DOE/ER/10774—4) Very high energy gamma ray astrophysics. Technical progress report, April 1983-March 1984.** Lamb, R.C. (Iowa State Univ. of Science and Technology, Ames (USA)). Mar 1984. Contract AC02-80ER10774. 9p. NTIS, PC A02; 3; GPO Dep. Order Number DE84010027.

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Our scientific goal is to discover and study by means of gamma ray astronomy those regions of the universe where particles are accelerated to extreme energies. The atmospheric Cerenkov technique provides a unique and potentially sensitive window in the region 10^{11} to $\sim 10^{14}$eV for this purpose. The Mt. Hopkins collaboration is currently engaged in the development of an improved sensitivity Cerenkov receiver utilizing a 37 element camera which images the Cerenkov signals in the focal plane of the Whipple Observatory's 10m reflector. Iowa State's contributions to this effort are principally in four areas: observations, development of an auxiliary 3m reflector, development of modular electronics as an eventual upgrade of the present hard-wired system, and data analysis.

21167 **(IFT-P—01/82) Cosmological model with compact space sections and low mass density.** Fagundes, H.V. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701057.

A general relativistic cosmological model is presented, which has closed space sections and mass density below a critical density similar to that of Friedmann's models. The model may predict double images of cosmic sources.

21168 **(IFT-P—07/82) Parastatistics and the equation of state for the early universe.** Aldrovandi, R.; Monte Lima, I. do. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701053.

The equation of state for an ideal mixture of relativistic quantum gases obeying any (para-) statistics is given. Recursion formulas are obtained for the distribution functions and correlations are analysed. The equation of state can be applied to the early Universe, allowing the quarks to be treated either as coloured fermions of (unequivalently) as parafermions of order 3. In the latter case, a tendency to aggregate into triads by a mere statistical effect is exhibited.

21169 **(IFT-P—15/82) Quadrupole component of the relic radiation in a quasi-hyperbolic cosmological model.** Fagundes, H.V. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). Sep 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701058.

A closed cosmological model is fitted to the quadrupole moment of the background radiation and to Hubble's constant. Then an anisotropy in the latter is predicted, as well as the values of deceleration parameters, the density ratio Ω, and (more speculatively) the total mass of the universe.

21170 **(IFUSP-P—342) Alternative view of cosmological phase transitions.** Marques, G.C.; Ventura, I. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701059.

A description of cosmological phase transitions, which differs from the one based on the effective potential approach is presented. In this scheme, the phase transition is driven by the spontaneous generation of domain walls (solitons), and below the critical point, statistical mechanics prohibits the existence of these walls.

21171 **(INPE—2333) Observational techniques of gamma ray astronomy in low energy.** Costa, J.M. da. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Feb 1982. 108p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84701063.

Due to the absorption of a great part of the gamma-ray spectrum of cosmic origin, by the earth's atmosphere at heights above 20Km, gamma-ray astronomy achieved its full development only after the advent of the space age. Ballons and satellites are the space vehicles which have been used to transport gamma-ray telescopes to observational heights in the atmosphere, or out of it. The results of these experiments can determine the sources, the energy spectra and the intensities of the cosmic gamma-rays, and provide other important information of astrophysical interest. The detection of gamma-rays of cosmic origin is very difficult. The observational techniques used in gamma-ray astronomy are dependent on the energy range of the gamma-rays which one desires to detect. The most common telescopes of low energy gamma-ray astronomy (50KeV - 20MeV) use NaI(Tl) scintillators, or germanium diodes, as principal detectors, surrounded by an active shield (anticoincidence) of organic or inorganic scintillators.

21172 **(INPE—2371) Measures of gamma rays between 0,3 MeV and 3,0 MeV and of the 0,511 MeV annihilation line coming from Galactic Center Region.** Jardim, M.V.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Apr 1982. 68p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701064.

The detection of the flux of the electron-positron annihilation line coming from the Galactic Center direction allows one to estimate the rate of positrons production and the corresponding luminosity. The results of measurements of the annihilation line flux intensity at 0.511 MeV, obtained with a balloon borne experiment to measure gamma rays in the energy interval 0.3 to 3 MeV are presented. The detector looked at the galactic disk in the longitude interval $-31^\circ < 1\ \text{sup (II)} < +41^\circ$ and observed a flux intensity of $(6.70 \pm 0.85) \times 10^{-3}$ photons $cm^{-2}\,s^{-1}$, which is in good agreement with the flux value estimated assuming that the Galactic Center is a line source emitting uniformly. Some likely sources of positrons and annhilation regions are also discussed. The results for the continuum spectrum emitted from the Galactic Center in the energy interval 0.3 to 0.67 MeV are presented and compared with measurements had already made.

21173 **(INPE—2483) Measurements of the low-energy gamma-ray continuum emission from the Galatic Center direction.** Jardim, M.V.A.; Martin, I.M.; Jardim, J.O.D. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jul 1982. 12p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701055.

The measurement of the gamma-ray continuum emission from the Galactic Center (GC) can provide us information about the physical processes taking place there at the site of emission. Using the data obtained with a balloon-borne gamma-ray telescope to measure gamma-rays in the energy interval between 0.3 and 3 MeV, which was launched on March 28, 1980 from Cachoeira Paulista (SP), we calculeted two points for the continuum spectrum in the range between 0.34 and 0.67 Mev. The points are related to the GC emission radiated in the longitude interval $-31^\circ < 1\ \text{sup(II)} < +41^\circ$. The measurements are compatible with the observations in 1969 and 1972 by Haymes et alii and Johnson, respectively. The power law spectrum suggests that the main component for the gamma-ray continuum emission below 10 MeV is dominated by the bremsstrahlung due to relativistic electrons.

21174 **(KFKI—1983-77) Viscosity and the monopole density of the universe.** Diosi, L.; Lukacs, B.; Keszthelyi, B.; Paal, G. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jul 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701060.

It is shown that GUT monopoles with energy about 10^{16} GeV might themselves solve the so-called monopole problem of GUT cosmologies by their unavoidable viscosity, which may lead to a quasi-inflationary scenario even without appeal to a 'false vacuum'.

21175 **(ON—01/82) Radiation transfer in stellar interiors.** Opher, R. (Observatorio Nacional, Rio de Janeiro (Brazil)). 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701054.

It was recently shown that due to the quantum nature of the plasmon-electron interaction the radiation transfer at the center of the sun (when free-free processes dominate the opacity) increases by a factor Q(identical to H sub(d)/H) > 2 (Opher, 1981), where H sub(d) (H) is the corrected (uncorrected) radiation transfer. Here the case when electron scattering-dominates the opacity is analyzed. It is found that the temperature and density dependence of Q_1 (due to the quantum nature of the plasmon-electron interaction) can be expressed in terms of the single parameter u sub(p) identical to $(h/2\pi)$w sub(pe)/K sub(B) T varies as n sup (1/2)/T, where $(h/2\pi)$w sub(pe) is the plasmon energy, T is the temperature, n is the electron density, and K sub(B) is Boltzmann's constant. This can be compared with the temperature and density dependence of Q_2 (due to Debye correlations) for a given chemical composition, which is dependent on the parameter α identical to n sup(1/3)/T. The parameter Q_1 (Q_2) increases with increasing u sub(p) (α). In general, the relaation $Q = Q_1Q_2$ holds and large values of Q are predicted for stars of mass M> sub (circle) M. As an example it is found that in a 3M sub (circle) star at the beginning of the triple-α process, the value of Q is approximately equal to 1.5 (i.e. the effective electron scattering opacity is approximately equal to 2/3 of its normal value).

21176 **(UFRJ-IF—16/83) Bianchi-I cosmology with non minimally coupled electro-magnetic field.** Accioly, A.J.; Vaidya, A.N.; Som, M.M. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701061.

The Bianchi type - I model has been investigated in the light of non-minimal coupling of 4-vector potential of the electromagnetic field with gravity. Some interesting models are discussed when the vector potential is curl-free.

21177 **Infrared study of the Crab pulsar: The "shoulder" pulse and the 3.45 micron pulse profile.** Middleditch, J.; Pennypacker, C.; Burns, M.S. (Los Alamos National Laboratory, Los Alamos, New Mexico). *Astrophysical Journal;* **273**: No. 1, 261-266(1 Oct 1983). Contract AC03-76SF00098.

Infrared measurements of the Crab pulsar with the NASA IRTF 3.0 m telescope show that the spectrum of the main pulse turns downward for wavelengths longer than 3 μm. The "shoulder" pulse discovered by Pennypacker is measured in the 0.9—2.4 μm region, but disappears at 3.5 μm. This pulse rises from 0 to 20% of the height of the main pulse within 1 to 2 ms after the main pulse peak and decays with a 4 to 5 ms time constant. Excess infrared flux also appears after the interpulse. The main peak itself may be narrower at 3.45 μm than in the optical to 2.2 μm band.

21178 **Concentrations in the Local Association. 1. The southern concentrations NGC 2516, IC 2602, Centaurus-Lupus and Upper Scorpius.** Eggen, O.J. (Cerro Tololo Inter-American Observatory, La Serena (Chile)). *Monthly Notices of the Royal Astronomical Society;* **204**: No. 1, 377-390(Jul 1983).

Extensive intermediate band and Hβ observations and the available astrometry, have been used to support the suggestions that (1) several southern concentrations of stars are moving with the Pleiades and α Persei clusters (Local Association) and (2) the Local Association contains an appreciable percentage of the main-sequence stars near the Sun but the non-random distribution of the brighter association members focuses attention on a few concentrations, or 'clusters'. (3) All of the concentrations discussed here are larger than about 10 pc and the largest, in Lupus-Centaurus, is shown to be accompanied by A to G type main-sequence stars.

21179 **Concentrations in the Local Association. 2. The northern concentrations including the α Persei, Pleiades, M34 and delta Lyrae clusters.** Eggen, O.J. (Cerro Tololo Inter-American Observatory, La Serena (Chile)). *Monthly Notices of the Royal Astronomical Society;* **204**: No. 1, 391-403(Jul 1983).

New intermediate band and Hβ observations of members of the delta Lyrae cluster, and previous photometry of the Pleiades, α Persei and M34 clusters, is discussed in connection with the available astrometry. The small age spread shown by the members of these clusters is the same as that for the southern concentrations previously discussed. The limited astrometric data do not support a linear expansion, contraction or differential motions within the association as a whole but may indicate variations in the stream motion at various parts of the association, and this variation may be the effect of differential galactic rotation. A complete sample of bright, northern B-type stars indicates that the association members constitute a third of that population and the HgMn and Ap stars in the sample are represented in the association by the same percentage.

21180 **Concentrations in the Local Association. 3. Late-type bright giants, ages and abundances.** Eggen, O.J. (Cerro Tololo Inter-American Observatory, La Serena (Chile)). *Monthly Notices of the Royal Astronomical Society;* **204**: No. 1, 405-414(Jul 1983).

The bright giants and supergiants of types F to K amongst association members in the concentrations and in the general field are over-abundant in metals, with P[Fe/H] approx. 0.25. These bright giants, and the early-type association members brighter than about Msub(V)= - 1 mag (mode B stars), are younger than 5 or 6 x 10^7 yr. The fainter (mode A) main-sequence members of the association are near 2 x 10^8 yr with P[Fe/H] approx. O.

6402 Atmospheric Physics

21181 **(INPE—2416) Spread F plasma bubble vertical rise velocities determined from spaced ionosonde observations.** Abdu, M.A.; Medeiros, R.T. de; Sobral, J.H.A.; Bittencourt, J.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). May 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701051.

Systematic time differences in the onsets of spread F events in the ionograms are observed between the magnetic equatorial station Fortaleza (4°S, 38°W, dip latitude 1.8°S) and the low latitude station Cachoeira Paulista (23°S, 45°W, dip latitude 14°S), two stations in Brazil, located at close by magnetic meridional planes (actually some 12° of magnetic longitude apart). On the assumption, justified from different experimental observations, that the spread F irregularities occur in strongly field aligned plasma bubbles that extend several degrees on either side of the magnetic equator, and rise up in vertically elongated columns over the magnetic equator, the observed time differences in the onsets of spread F events at the two stations, have related, to the plasma bubble vertical rise velocities over the magnetic equator. The vertical rise velocities of the plasma bubble so determined are found to be well within the values measured by VHF radar and satellite techniques, and further show, at times, good correlation with the amplitude of the prereversal peak in the vertical drift velocities and the heights of the evening equatorial F-layer. Possible implications of these results are discussed.

21182 **(TRITA-EPP—83-01) Auroral arc classification scheme based on the observed arc-associated electric field pattern.** Marklund, G. (Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics). Jun 1983. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700756.

Radar and rocket electric field observations of auroral arcs have earlier been used to identify essentially four different arc types, namely anticorrelation and correlation arcs (with, respective-

ly, decreased and increased arc-assocaited field) and asymmetric and reversal arcs. In this paper rocket double probe and supplementary observations from the literature, obtained under various geophysical conditions, are used to organize the different arc types on a physical rather than morphological basis. This classification is based on the relative influence on the arc electric field pattern from the two current continuity mechanisms, polarisation electric fields and Birkeland currents. In this context the tangential electric field plays an essential role and it is thus important that it can be obtained with both high accuracy and resolution. In situ observations by sounding rockets are shown to be better suited for this specific task than monostatic radar observations. Depending on the dominating mechanism, estimated quantitatively for a number of arc-crossings, the different arc types have been grouped into the following main categories: Polarisation arcs, Birkeland current arcs and combination arcs. Finally the high altitude potential distributions corresponding to some of the different arc types are presented.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 20610, 20702, 21252, 21372

21183 **(AERE-R—10848) HARWELL version of the computer code E-DEP-1.** Matthews, M.D. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). Mar 1983. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701048.

This document describes the modified HARWELL version of the computer program EDEP-1 which has been in use on the IBM Central Computer for some years. The program can be used to calculate heavy ion ranges and/or profiles of energy deposited into nuclear processes for a wide variety of ion/target combinations. The initial setting up of this program on the IBM Central Computer has been described in an earlier report. A second report was later issued to bring the first report up to date following changes to this code required to suit the needs of workers at HARWELL. This later report described in particular the provision of new electronic stopping powers and an alternative method for calculating the energy straggle of beam ions with depth in a target. This new report describes further extensions to the electronic stopping powers available in the HARWELL version of this program and, for the first time, gives details of alternative nuclear stopping powers now available. This new document is intended as a reference manual for the use of the HARWELL version of EDEP-1. In this respect this document should be the final report on the status of this program.

21184 **(CBPF-MO—005/82) Some features of excited states density matrix calculation and their pairing relations in conjugated systems.** Giambiagi, M.S. de; Giambiagi, M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701029.

Direct PPP-type calculations of self-consistent (SC) density matrices for excited states are described and the corresponding 'thawn' molecular orbitals (MO) are discussed. Special attention is addressed to particular solutions arising in conjugated systems of a certain symmetry, and to their chemical implications. The U(2) and U(3) algebras are applied respectively to the 4-electron and 6-electron cases: a natural separation of excited states in different cases follows. A simple approach to the convergence problem for excited states is given. The complementarity relations, an alternative formulation of the pairing theorem valid for heteromolecules and non-alternant systems, allow some fruitful experimental applications. Together with the extended pairing relations shown here, they may help to rationalize general trends.

21185 **(CONF-830780—4) Attractive interaction between an atom and a surface.** Manson, J.R.; Ritchie, R.H. (Clemson Univ., SC (USA). Dept. of Physics and Astronomy; Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84003204.

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

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Using a general self-energy formalism we examine the interaction between an atom and a surface. Considered in detail are deviations from the Van der Waals force due to recoil and finite velocity of the particle. Calculations for positronium near a metal surface show that for such systems recoil and velocity effects are significant even at very low energies. We also examine the mechanisms for energy exchange with the surface and calculations show that single quantum events do not always dominate the exchange rates. 8 references, 2 figures.

21186 **(CONF-840387—3) Photoionization of excited molecular states using multiphoton excitation techniques.** Dehmer, P.M.; Pratt, S.T.; Dehmer, J.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009150.

From 2. topical meeting on laser techniques in the extreme ultraviolet; Boulder, CO, USA (5 Mar 1984).

Photoelectron spectra are reported for three photon resonant, four photon ionization of H_2 via the B $^1\Sigma$/sub u/$^+$, v = 7 (J = 2,4) and C $^1\pi$/sub u'/, v = 0-4 (J = 1) levels and of N_2 via the o_3 $^1\pi$/sub u'/, v = 1,2, b $^1\pi$/sub u'/, v = 3-5, and c $^1\pi$/sub u'/, v = 0 levels. The results reflect both the spectroscopy and the dynamics of photoionization of excited molecular states and are discussed in terms of the selection rules for photoionization and the relative probabilities of photoionization from Rydberg and valence states. In some cases, in accordance with the Franck-Condon principle, the results demonstrate that resonant multiphoton ionization through Rydberg states may be a powerful technique for the production of electronic, vibrational, and rotational state selected ions. However, in other cases, systematic departures from Franck-Condon factors are observed, which reflect the more subtle dynamics of excited state photoionization. 23 references, 6 figures, 2 tables.

21187 **(CONF-840415—18) Shape resonances in molecular fields.** Dehmer, J.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 44p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009206.

From 187. national meeting of the American Chemical Society; St. Louis, MO, USA (8 Apr 1984).

A shape resonance is a quasibound state in which a particle is temporarily trapped by a potential barrier (i.e., the shape of the potential), through which it may eventually tunnel and escape. This simple mechanism plays a prominent role in a variety of excitation processes in molecules, ranging from vibrational excitation by slow electrons to ionization of deep core levels by x-rays. Moreover, their localized nature makes shape resonances a unifying link between otherwise dissimilar circumstances. One example is the close connection between shape resonances in electron-molecule scattering and in molecular photoionization. Another is the frequent persistence of free-molecule shape resonant behavior upon adsorption on a surface or condensation into a molecular solid. The main focus of this article is a discussion of the basic properties of shape resonances in molecular fields, illustrated by the more transparent examples studied over the last ten years. Other aspects to be discussed are vibrational effects of shape resonances, connections between shape resonances in different physical settings, and examples of shape resonant behavior in more complex cases, which form current challenges in this field.

21188 **(CONF-840555—3) Photoionization of excited molecular states using multiphoton excitation techniques.** Dehmer, P.M.; Pratt, S.T.; Dehmer, J.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84004034.

From Spring meeting of the Electrochemical Society; Cincinnati, OH, USA (6 May 1984).

Resonantly enhanced multiphoton ionization (REMPI) affords the opportunity to select a specific ionization pathway in order to produce a particular ionic state for further study or to investigate detailed aspects of excited state photoionization dynamics. The production of electronic or vibrational state-selected ions using REMPI can be achieved by first preparing an intermediate Ryd-

berg state that has a potential energy curve similar to that of the final desired ionic state, and then ionizing the Rydberg state with a single additional photon. Under these circumstances, the Franck-Condon factors governing the final ionization step strongly favor the preservation of the Rydberg state core. 1 figure.

21189 **(CTA-EAV—017/81) Multiphoton emission during U.V. and X-ray absorption by atoms in intense laser fields.** Miranda, L.C.M. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Atividades Espaciais). Sep 1981. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701001.

A discussion of the u.v. and x-ray absorption cross section by a hydrogen atom in the presence of an intense i.r. laser field is presented, taking into account the influence of laser field on the electronic states.

21190 **(CTA-LEA—010/81) Calculation of the ground and excited states of the Ne_2 molecule by the variational cellular method.** Dias, A.M.; Rosato, A. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Atividades Espaciais). Jul 1981. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701030.

The potential curves for the ground state $^1\Sigma^+$ sub(g) and for the first singlet excited state $^1\Sigma^+$ sub (u) of the Ne_2 molecule are determined by the Variational Cellular Method. From these curves some spectroscopical constants are obtained. Ionization energies of the excited state $^1\Sigma^+$ sub (u) are calculated.

21191 **(DOE/ER/10512—4) Differential charge transfer and continuum electron capture studies for ions in atomic hydrogen. Final report, August 1, 1979-September 31, 1983.** Sellin, I.A.; Elston, S.B. (Tennessee Univ., Knoxville (USA)). 1983. Contract AS05-79ER10512. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009675.

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A final technical narrative is given of progress and results obtained during the period August 1, 1979 through September 30, 1983 in a project designed to test existing theories of electron capture to continuum states of fully stripped nuclei traversing atomic hydrogen targets. 5 references.

21192 **(DOE/ER/12081—5) Hyperspherical coordinate theory of two electron atomic processes. Progress report, 1 August 1983-31 July 1984.** Macek, J.; Starace, A.F. (Nebraska Univ., Lincoln (USA)). Mar 1984. Contract AC02-82ER12081. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009447.

Electron correlations are studied in two-electron atoms using theoretical methods employing hyperspherical coordinates. The doubly differential cross section for detachment of H^- by impact with He is studied using adiabatic hyperspherical coordinate initial and final state wavefunctions to compute the H^- form factors. The detached electron's angular distribution is highly sensitive to electron correlations. A pseudo-state method is developed to correct the gross inaccuracies of adiabatic hyperspherical wavefunctions at large radial distances. This procedure yields significantly improved ^1S elastic phase shifts for electron scattering on atomic hydrogen. The Fock series expansion for two electron wavefunctions has been successfully implemented numerically. When matched to single channel adiabatic functions for some radius R_0, the Fock wavefunctions for He and H^- differ little (for $O < R < R_0$) from the adiabatic wavefunctions, at least for the lowest adiabatic channels. This confirms recent results of Christensen-Dalsgaard. The R-matrix for sytems of coupled differential equations containing first derivative coupling matrix elements is found to be asymmetric. An alternative matrix (equal to the sum of the inverse R-matrix and the first derivative coupling matrix) is found to be symmetric. The Wannier threshold energy dependence of cross sections and angular distributions is derived quantum mechanically by J.M. Feagin for the Coulomb breakup of three-particle systems with arbitrary angular momentum. 8 references, 3 figures.

21193 **(DOE/ER/13098—1) Quantum mechanical studies of heavy ion scattering processes. Progress report, July 15, 1983-March, 1984.** Heil, T.G. (Georgia Univ., Athens (USA). Dept. of Physics and Astronomy). 15 Mar 1984. Contract AS09-83ER13098. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010124.

The research done under this contract should provide valuable contributions to our understanding of atomic collision processes. The essence of this project is the description of low energy atomic collision process using molecular states formed by the collision partners in the interaction region. Over the eight months that this contract has been in effect, significant progress has been made on both fundamental and applied levels. On the most basic level, we have recently developed a new diabatic representation of the scattering which has none of the defects associated with the most commonly used formulation of Smith. This may prove to be of great importance since a proper diabatic description is thought to be a more reasonable representation of the actual physical scattering process than the adiabatic description. It should be noted that there is a great deal of controversy surrounding the word proper but our new formulation satisfies most, if not all, criteria for diabatic states. In addition, we have carried out or initiated theoretical studies on a number of atomic scattering processes involving charge transfer reactions and proton-induced fine-structure transitions. Our calculations of differential scattering cross sections for low energy charge transfer reaction should be of particular importance. A number of experimental groups are now proposing to measure these cross sections which our calculations predict should have large, striking features. Such comparisons would provide valuable tests of the theory of low energy atomic collision processes on a more fundamental level than previous comparisons of the total cross sections.

21194 (INIS-SU—198, pp 236) **Semimicroscopic approach to calculation of level widths in pionic atoms. Results for the 2p and 3d level widths in ^{56}Fe, ^{58}Ni, ^{64}Co and ^{66}Zn mesic atoms.** Birbrair, B.L.; Kalashnikov, Yu.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21195 (INIS-SU—198, pp 237) **Invesrse gamma quanta conversion for thermal muons.** Karpeshin, F.F. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21196 (INIS-SU—198, pp 279) **Mesic atom production in annihilation of electron pair in a nucleus field.** Mikhajlov, A.I.; Fomichev, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21197 (KEK—81-16, pp 1-11) **Present status and future prospect in use of picosecond electron pulse.** Tabata, Yoneho (Tokyo Univ. (Japan)). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105236—).

From Meeting on pulsed structure of synchrotron radiation and its applications; Oho, Ibaraki, Japan (29 May 1981).

The historical background of picosecond pulse radiolysis is briefly mentioned. Recent experimental results obtained at the Nuclear Eingineering Research Laboratory, University of Tokyo by using a picosecond pulse radiolysis system are presented. Finally, a possible use of a single bunch of picosecond electron pulse which will be available at the photon factory in Tsukuba under now construction is proposed.

21198 **(KEK—81-16) Proceedings of the meeting on pulsed structure of synchrotron radiation and its applications.** Hatano, Y.; Ohta, T. (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jan 1982. 82p. (In Japanese). (CONF-8105236—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780098.

From Meeting on pulsed structure of synchrotron radiation and its applications; Oho, Ibaraki, Japan (29 May 1981).

Abstracts of individual items from the proceedings were prepared separately for the data base. (GHT)

21199 **Electric-dipole moment of CaF (X $^2u^+$) by molecular beam, laser-RF, double-resonance study of Stark splittings.** Childs, W.J.; Goodman, L.S.; Nielsen, U.; Pfeufer, V. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **80**: No. 6, 2283-2287(15 Mar 1984). Contract W-31-109-ENG-38.

The molecular beam, laser-RF, double-resonance technique has been used to measure the electric-dipole moment of the X $^2\Sigma^+$ (v = 0) electronic ground state of CaF. The moment was determined to be 3.07(7) D by measuring the Stark shifts of RF transitions within specified rovibrational states of X $^2\Sigma^+$.

21200 **Electronic energy level and intensity correlations in the spectra of the trivalent actinide aquo ions. III. Bk^{3+}.** Carnall, W.T.; Beitz, J.V.; Crosswhite, H. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **80**: No. 6, 2301-2308(15 Mar 1984). Contract W-31-109-ENG-38.

The solution absorption spectrum of Bk^{3+}(aquo) was measured and the observed band structure interpreted in terms of a free-ion energy level model. The band intensities were successfully analyzed using the Judd—Ofelt theory for transitions within the f/sup tsN/ configuration. Parameters of the theory were then used to compute fluorescence branching ratios from most probable fluorescing states, and an experimental search was successful in yielding evidence for a transition from one excited state to the ground state in D_2O solvent. Absorption bands attributed to f → d transitions were observed and an interpretation of the electronic structure is presented. Band intensities were compared to those observed for Tb^{3+}(aquo).

21201 **Development of an atom buncher.** Hurst, G.S.; Payne, M.G.; Phillips, R.C.; Dabbs, J.W.T.; Lehmann, B.E. (Chemical Physics Section, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Applied Physics;* **55**: No. 5, 1278-1284(1 Mar 1984). Contract W-7405-ENG-26.

An "atom buncher" for controlling the concentration of gaseous samples has been conceptualized, evaluated theoretically, fabricated, and tested with excellent results. In effect, the atom buncher greatly increases the probability that a free atom will be in a small detector volume at a desired time. This was accomplished by using cryogenic techniques to condense atoms on a small spot and a pulsed laser to momentarily heat the spot to release the atoms at the desired time. Our work on noble gas atom counting by using resonance ionization spectroscopy is discussed as one example of the applications of the atom buncher.

21202 **Ion source operation with different magnetic confinement geometries.** Leung, K.N.; Ehlers, K.W. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Review of Scientific Instruments;* **55**: No. 3, 342-346(Mar 1984). Contract AC03-76SF00098.

A comparison has been made between the longitudinal line cusp and the "continuous" checkerboard magnet geometries. We find that the checkerboard arrangement can provide a larger uniform density profile with approximately 20% less plasma density than the longitudinal line cusp. Results seem to indicate that the reduction in plasma density is closely related to the containment of primary ionizing electrons by the permanent magnets. A new magneto-electrostatic containment scheme was generated by using an internal magnetic cage system. The overall efficiency of this ion source was increased when it was operated with a xenon or argon plasma.

21203 **Multiple ionization of rare gases by H^+ and He^+ impact.** DuBois, R.D.; Toburen, L.H.; Rudd, M.E. (Pacific Northwest Laboratory, Richland, Washington 99352). *Physical Review [Section] A: General Physics;* **29**: No. 1, 70-76(Jan 1984). Contract AC06-65RL01830.

Absolute cross sections for multiple ionization (σ/sub q/) of He, Ne, Ar, and Kr are presented for proton-impact energies between 10 and 4000 keV. Charge states up to 6+ are observed for Kr. The results are obtained by measuring relative yields of multiply charged ions with a time-of-flight spectrometer and normalizing to total ion-production cross sections σ/sub T/ = summationqσ/sub q/. The results are compared with existing proton- and electron-impact data. Relative multiple- to single-ionization cross-section ratios are also presented for He^+ impact.

21204 **Dissociative attachment to rovibrationally excited H_2.** Wadehra, J.M. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review [Section] A: General Physics;* **29**: No. 1, 106-110(Jan 1984). Contract AC03-76SF00098.

Using a local-width resonant model, the cross sections for dissociative attachment of low-energy electrons to a rovibrationally excited H_2 molecule in its ground electronic state are obtained. There are 294 such rovibrational levels. Only the contribution of the $^2\Sigma$/sub u/$^+$ resonant state of H_2^- to the attachment process is investigated. Assuming a Maxwellian distribution for electron energies, the dissociative attachment cross sections are converted into attachment rates for various rovibrational levels of H_2. A significant enhancement of attachment rates occurs for endoergic reactions only, and the maximum possible rate for attachment to the ground electronic state of H_2 is about 10^{-8} cm^3/sec. Using the same energy distribution for electrons, the average energy carried by the H^- ions is calculated for all possible rovibrational levels. More energetic ions are formed when the attachment process is exoergic, and even the most energetic H^- ions have energies less than 0.5 eV. Furthermore, the attachment rates and the average ion energy appear to depend roughly on the total internal energy and not on the exact fraction of internal energy in rotational or vibrational modes.

21205 **Observations of induced transitions in the uv absorption spectrum of Ba.** Kelly, J.F. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] A: General Physics;* **29**: No. 1, 144-151(Jan 1984). Contract W-31-109-ENG-38.

The uv absorption spectrum of Ba vapor is studied, noting its dependence on both vapor density and the intensity of illumination. Wavelength positions of the weak absorption lines, which appear adjacent to the 6snp $^1P_1$/sup o/ principal series for n> or ≈35, have been identified as the $6s^2$ $^1S_0$ to 6sns $^1S_0$ and 6snd $^1D_2$ even-parity transitions. Experimental evidence is presented to support the interpretation of these transitions as collision-induced phenomena.

6404 Fluid Physics

21206 **(IFUSP-P—315) Linear birefringence and optical ativity in a magnetized plasma.** Vuolo, J.H.; Galvao, R.M.O. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Feb 1982. 37p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701049.

Linear birefringence and optical activity are considered separately to electromagnetic wave propagation in magnetized cold plasma, using frequency approximation much bigger than plasma frequency. It's showen that in some interesting cases, those phenomena could be independents. Explicit expressions are obtained for refraction indices to linear birefringency and optical activity. The correspondents indices attenuation aRe obtained in first orden of attenuation. It's showen that the characteristic states for linear dichroism coincide with the characteristic states for linear birefringence. The characteristic states for elliptic dichroism are obtained.

21207 **(INPE—2321) Experimental works about plasma, developed in INPE (Spatial Research Institute). Parts 1 and 2.** Ferreira, J.L.; Del Bosco, E.; Ludwig, G.O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Feb 1982. 15p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701050.

Some experiments done at the Plasma Physics Laboratory at INPE are described. In the first part, the double plasma machine used for the study of ion acoustic wave propagation is described, and the results obtained so far are shown. The second part consists

in the description of a plasma centrifuge project. It contains some basic parameters of our apparatus used for isotope separation, through electromagnetic rotation of the plasma.

21208 **(K/TS—11-111) Dynamics of Bernoulli-Euler beams conveying compressible fluid.** Johnson, R.O.; Stoneking, J.E.; Carley, T.G. (Oak Ridge Gaseous Diffusion Plant, TN (USA); Tennessee Univ., Knoxville (USA)). 1984. Contract W-7405-ENG-26. 6p. (CONF-840504—1). NTIS, PC A02; 3; GPO Dep. Order Number DE84005066.

From Southeastern conference on theoretical and applied mechanics; Pine Mountain, GA, USA (10 May 1984).

Paper copy only, copy does not permit microfiche production.

The eigenvalue problem associated with the equations of motion of a compressible, fluid-conveying, cantilevered, Bernoulli-Euler beam or tube is solved using Muller's method. Compressibility affects the dynamics of the system through tube aspect ratio and fluid sonic velocity. Parametric studies indicate that aspect ratio has a more pronounced influence on the critical velocity than sonic velocity. 15 references.

21209 **Green's functions at zero viscosity.** Fried, H.M.; Tessendorf, J. (Department of Physics, Brown University, Providence, Rhode Island 02912). *Journal of Mathematical Physics (New York);* **25**: No. 4, 1144-1154(Apr 1984). Contract AC02-76ER03130.

Fradkin-type propagator representations are written for solutions to Navier—Stokes and related equations, for arbitrary dimension D and arbitrary source geometry. In the limit of very small viscosity, velocity/vorticity solutions are given in terms of Cauchy position coordinates q of a particle advected by the velocity flow v, using a set of coupled equations for q and v. For localized point vortices in two dimensions, the vectors q become the time-dependent position coordinates of interacting vortices, and our equations reduce to those of the familiar, coupled vortex problem. The formalism is, however, able to discuss three-dimensional vortex motion, discrete or continuous, including the effects of vortex stretching. The mathematical structure of vortex stretching in a D-dimensional fluid without boundaries is conveniently described in terms of an SU(D) representation of these equations. Several simple examples are given in two dimensions, to anchor the method in the context of previously known, exact solutions. In three dimensions, vortex stretching effects are approximated using a previous "strong coupling" technique of particle physics, enabling one to build a crude model of the intermittent growth of enstrophy, which may signal the onset of turbulence. For isotropic turbulence, the possibility of a singularity in the inviscid enstrophy at a finite time is related to the behavior of a single function characterizing the intermittency.

21210 **Bulk acceptor compensation produced in p-type silicon at near-ambient temperatures by a H_2O plasma.** Hansen, W.L.; Pearton, S.J.; Haller, E.E. (Lawrence Berkeley Laboratory and Department of Materials Science and Mineral Engineering, University of California, Berkeley, California 94720). *Applied Physics Letters;* **44**: No. 6, 606-608(15 Mar 1984). Contract AC03-76SF00098.

We report the neutralization of the shallow acceptors boron and gallium in p-type silicon to a depth >1 μm after exposure to a H_2O plasma for 3 h at temperatures as low as 80 °C. The fact that uncompensated n-type silicon is unaffected by the plasma treatment means that donor formation is excluded. Exposure to either O_2 or H_2 plasmas does not lead to acceptor removal; however, sequential treatment in an O_2 plasma followed by a H_2 plasma produces the same effect as the H_2O plasma while the inverse sequence has no effect. Our observations can be explained with a model considering rapidly diffusing atomic oxygen and hydrogen which recombine on acceptor sites forming neutral A^-OH^+ complexes. The model shows that acceptor compensation kinetics is dominated by the diffusion of atomic hydrogen.

21211 **Pseudopotential theory of interacting roton pairs in superfluid ^{4}He.** Bedell, K.; Pines, D.; Zawadowski, A. (Department of Physics, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801; and Department of Physics, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review [Section] B: Condensed Matter;* **29**: No. 1, 102-122(1 Jan 1984). Contract AC02-76ER13001.

A configuration-space pseudopotential, which is closely related to that used by Aldrich and Pines to describe the effective interaction between background particles in ^{3}He and ^{4}He, is constructed and used to calculate the roton-roton scattering amplitude. From that amplitude we obtain a theory that is completely congruent with the roton-liquid theory of Bedell, Pines, and Fomin. We calculate two-roton bound states, roton-liquid parameters, and roton lifetimes, as well as information about the hybridization of the two-roton bound state with excitations of higher and lower energy. Excellent agreement between theory and experiment is obtained for the $l = 2$ bound state at zero pair momentum, the roton lifetime, the roton contribution to the normal-fluid viscosity and the normal-fluid density, and the temperature variation of the roton energy. The effective roton-roton coupling parameters at large pair momentum are found to be an order of magnitude larger than those for small or vanishing pair momentum. At SVP we find that a substantial number of two-roton bound states of varying symmetry exist for pair momentum up to $\sim 3\ A^{-1}$; at standard pressure, however the roton-roton interaction for momenta $\sim 1\ A^{-1}$ is found to become repulsive, so that both the $l = 2$ bound state at zero pair momentum and bound states at intermediate momenta are predicted to disappear under pressure.

6450 High Energy Physics

21212 **(IFT-C—01/82) Introduction to the elementary particle physics.** Shellard, R.C. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). Mar 1982. 369p. (In Portuguese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE84701065.

An introduction is given to the subject of elementary particle physics. Several particle properties are discussed and some models are shown. This introduction covers the theoretical as well as the experimental aspects including a topic on detectors.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 20675

21213 **(BNL—34315) Results on nu/sub μ/e elastic scattering.** Ahrens, L.A.; Aronson, S.H.; Connolly, P.L.; Callas, J.L.; Cutts, D.; Amako, K.; Nagashima, Y.; Abe, K.; Clarke, P.; Miyachi, T. (Brookhaven National Lab., Upton, NY (USA); Brown Univ., Providence, RI (USA). Dept. of Physics; National Lab. for High Energy Physics, Oho, Ibaraki (Japan); Osaka Univ. (Japan); Pennsylvania Univ., Philadelphia (USA). Dept. of Physics; State Univ. of New York, Stony Brook (USA); Tokyo Univ. (Japan). Inst. for Nuclear Study). 1983. Contract AC02-76CH00016. 8p. (CONF-830718—19). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008180.

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

A measurement of the nu/sub μ/e elastic scattering cross section is presented. These data analyzed were run at the Brookhaven AGS wide band neutrino beam ([E/sub nu/] = 1.5 GeV).

21214 **(DOE/ER/40036—3) Precision measurements of pion nucleon elastic scattering in the P3 energy region at LAMPF. 1984 progress report.** Sadler, M.E. (Abilene Christian Univ., TX (USA)). 29 Feb 1984. Contract AS05-81ER40036. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010037.

Portions are illegible in microfiche products.

This study is a continuation of the pion-nucleon program at the Los Alamos Meson Physics Facility. Previous measurements, in chronological order, have included differential cross sections for $\pi/$ sup +-/p elastic scattering at P/sub $\pi/$ = 378 - 687 MeV/c (LAMPF experiment 363), π^-p charge exchange for P/sub $\pi/$ = 247 - 687 MeV/c (LAMPF experiment 120), and measurements of the polarization asymmetry for π/sup +-/p -> π/sup +-/p and π^-p -> π^0n for P/sub $\pi/$ = 471 - 687 MeV/c (LAMPF experiments 120* and 120**, respectively). Two experiments were initiated in the past year, forward-angle differential cross sections for π^-p -> π^0n at P/sub $\pi/$ = 96 - 150 MeV/c (LAMPF experiment 809) and polarization asymmetry for π^-p - > γn (LAMPF experiment 804). Approved experiments which will be scheduled in the future are spin rotation measurements for π/sup +-/p -> π/sup +-/p (LAMPF experiments 806 and 807) and differential cross sections for π^-p -> π^0n near 0^0 and 180^0 at P/sub $\pi/$ = 471-687 MeV/c (LAMPF experiment 849). Another experiment, differential cross section measurements for π/sup +-/ elastic scattering on ^{3}He and ^{3}H (LAMPF experiment 546), has also been completed. The ^{3}He and ^{3}H targets form an isospin doublet analogous to the proton and neutron. The I_3 = -1/2 member (^{3}H) of the multiplet can be utilized as a target in this case, allowing a direct test of charge symmetry not achievable in the πN system due to the impossibility of a pure neutron target.

21215 **(IC—82/216) Longitudinal phase space (LPS) analysis of the interaction np→ppπ^- at Psub(n)=3-5 GeV/c.** Fatah, B.; Beshliu, C.; Gruia, S. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1982. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701073.

The reaction np→ppπ^- is analyzed at Psub(n)=5.10 and 3.83 GeV/c using longitudinal phase space (LPS) analysis. The distributions of ω (Van Hove's angle) along with the hexagonal plots are investigated in detail. From the ω-distributions it is possible to conclude that, whenever allowed, the diffractive mechanism (Pomeron exchange) dominates the three-body final state. For the first time the approximate percentage, on the basis of hexagonal distributions, of the different processes involved (diffractive, peripheral, etc.) is calculated which may very well agree with the expectations at these energies. The investigation has been performed at the Laboratory of High Energies, Laboratory of Computing Techniques and Automation, JINR, Dubna and Laboratory of Nuclear Physics, University of Bucharest.

21216 **(IFT-T—05/82) Higgs boson production in p-p sup(-) collisions.** Novaes, S.F. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 136p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84701032.

The possibilities of Higgs boson may be produced by 'proton-antiproton' collison in the next Generation (CERN and FERMILAB) are analysed. The quarks and gluons fission process about 540 and 2000 GeV are examined, concluding that the possibility to detect, whatever mass they have are very small.

21217 **(IHEP-HD—83-1) Study of hadronic final states from the e^+e^- annihilation and from Y and Y' decays by means of the DASP detector.** Waldi, R. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Hochenergiephysik; Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). Feb 1983. 150p. (In German). Library of Heidelberg Univ. (Germany, F.R.).

The hadronic final states of e^+e^- annihilation in the energy region of the Y and Y' mesons and the hadronic decays of these resonances are investigated. Special emphasis is put on the event shapes (topologies) of the final states, to discern various suggested decay mechanisms. The data taken with the DASP detector at the e^+e^- storage ring DORIS are compared to a Monte Carlo simulation of events for different models of the Y and Y' hadronic decays. All models are calculated using pseudoscalar and vector mesons and baryons in the hadronization process. It is shown that the Y decay is described best by the mechanism Y -> ggg, where each gluon fragments like a quark jet. Fragmentation as two collinear, equally energetic quark jets is excluded. This implies, that in models where gluons decay before fragmentation, the energy must be distributed unequally. Also the alternative model, that the Y decays partly via qanti q and partly like phase space can be ruled out. Pure phase space decays are even more different from out data. Events from Y' decays look similar to those from an Y. However, some differences are obvious, most pronounced a higher mean multiplicity. This behaviour can be explained by the higher energy and the existence of the prominent channel Y' -> Y$\pi\pi$. No twojet enhancement is seen, which would indicate a significant branching ratio for transition into the P state via one photon emission.

21218 (INIS-SU—198, pp 418) **Manifestation of weak neutral currents in the $n + p \rightarrow d + e^+e^-$ process.** Rekalo, M.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21219 **(JINR-D—1-82-921) Observation of a narrow baryon produced in neutron-carbon interactions.** Aleev, A.N.; Arefiev, V.A.; Balandin, V.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700721.

A narrow resonance decaying into $\Sigma^-(1385)$ and K^+ is observed. The mass of the resonance is 1960+-10 MeV/c^2 and its width is 26+-6 MeV/c^2 in a diffraction-like process. The product of the resonance production cross section and its decay probability is equal to 0.8+-0.1 μb per carbon nucleus. Possible spin-particles of the resonance are: $1/2^{+-}$, $3/2^-$, $5/2^+$, $7/2^-$.

21220 **(JINR-R—1-82-508) Analysis of collective properties of secondary particles in CC interactions at 4.2 GeV/c x per nucleon.** Agakishiev, G.N.; Akhababyan, N.; Baatar, Ts. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700722.

Collective properties of charged secondary particles produced in all and in multinucleon CC collisions at 4.2 GeV/c per nucleon are analysed. These are expressed in terms of sphericity, thrust, flatness, < Psub(out)sup(2) > and < Psub(in)sup(2) >. Production of secondary charged particles, collimated in the direction of colliding nuclei motion, is noticed. The experimental data are compared with the intranuclear cascade model predictions and with the calculations by the model assuming indepen-- dent nucleon-nuclear interactions. It is shown that collective properties of protons and compound particles (d, t, He) produced in multinucleon CC-collisions cannot be described by these models of noncollective type nucleus-nucleus interactions.

21221 **(KEK—81-12) Proceedings of TRISTAN July 1981 workshop. The first workshop on detectors for TRISTAN e+e- physics.** Unno, Y. (ed.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Oct 1981. 71p. (CONF-8107121—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780111.

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

Separate entries were made in the data base for the sections in the proceedings. (WHK)

21222 (KEK—81-23, pp 53-57) **New proposal for lepton-nucleus experiments.** Nagamine, K. (Tokyo Univ. (Japan)). Mar 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-8103183—).

From Workshop on physics with 12 GeV PS at KEK; Oho, Ibaraki, Japan (9 Mar 1981).

New types of lepton experiments have been considered for the future use of 12 GeV synchrotron at KEK. In particular, value as well as feasibility are discussed on the possible muon-nucleus scattering experiments. Studies of the nucleus by the electric muon scattering with a low momentum transfer are emphasized to investigate unrevealed new aspects of the nucleus. A layout of lepton scattering facility is considered including stopped muon and collimated neutrino experiments as possible by-procuts.

21223 (SLAC-PUB—3288) Particel substructure. A common theme of discovery in this century. Panofsky, W.K.H. (Stanford Linear Accelerator Center, CA (USA)). Feb 1984. Contract AC03-76SF00515. 11p. (CONF-8105244—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006776.

From Cherwell-Simon Memorial conference; Oxford, UK (8 May 1981).

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Some example of modern developments in particel physics are given which demonstrate that the fundamental rules of quantum mechanics, applied to all forces in nature as they became understood, have retained their validity. The well-established laws of electricity and magnetism, reformulated in terms of quantum mechanics, have exhibited a truly remarkable numerical agreement between theory and experiment over an enormous range of observation. As experimental techniques have grown from the top of a laboratory bench to the large accelerators of today, the basic components of experimentation have changed vastly in scale but only little in basic function. More important, the motivation of those engaged in this type of experimentation has hardly changed at all.

21224 Search for supersymmetric electrons. Gladney, L.; Hollebeek, R.J.; LeClaire, B.W.; Abrams, G.S.; Amidei, D.; Baden, A.R.; Boyarski, A.M.; Breidenbach, M.; Burchat, P.; Butler, F. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305; Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720; and Department of Physics, Harvard University, Cambridge, Massachusetts 02138). *Physical Review Letters;* **51**: No. 25, 2253-2256(19 Dec 1983). Contract AC03-76SF00515;W-7405-ENG-48;AC03-76SF00098.

A search for single electrons from the decay of singly produced scalar electrons has been made at the PEP storage ring at SLAC. No events of this type have been found in 123 pb^{-1} of data, resulting in a cross-section limit of less than 2.4 x 10^{-2} pb withing the detector acceptance, and a 95% confidence-level lower limit on the scalar-electron mass of 22.2 GeV/c^2.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 21253, 21263, 21279

21225 (CBPF-NF—023/82) Do spin 3/2 leptons exist. Fleury, N.; Spehler, D.; Lopes, J.L. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701067.

An elementary proof of the unicity of the wave equation for free spin 3/2 fields (and the corresponding Feynman Integral equation) is given. Covariant forms are exhibited and a heuristic SU(2) x U(1) model is adopted for the construction of possible (electromagnetic and weak currents) involving spin 3/2 particles. The notions of Dirac and Majorana masses for spin 3/2 neutrinos are generalized from the spin 1/2 case. Among the decays of charged massive spin 3/2 particles, the radiative decay into the spin 1/2 lepton of the same family is possible. A systematic experimental search for spin 3/2 leptons (and quarks) is urged.

21226 (DOE/ER/03992—538) Relativistic particle dynamics: Lagrangian proof of the no-interaction theorem. Marmo, G.; Mukunda, N.; Sudarshan, E.C.G. (Texas Univ., Austin (USA). Center for Particle Theory). Nov 1983. Contract AS05-76ER03992. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009147.

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An economical proof is given, in the Lagrangian framework, of the No Interaction Theorem of relativistic particle mechanics. It is based on the assumption that there is a Lagrangian, which if singular is allowed to lead at most to primary first class constraints. The proof works with Lagrange rather than Poisson brackets, leading to considerable simplifications compared to other proofs.

21227 (DOE/ER/03992—539) Spinorial relativistic rotator: the transformation from quasi-Newtonian to Minkowski coordinates. Biedenharn, L.C.; Bohm, A.; Tarlini, M.; van Dam, H.; Mukunda, N. (Texas Univ., Austin (USA). Center for Particle Theory). Dec 1983. Contract AS05-76ER03992. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009091.

There exists a remarkably close relationship between the operator algebra of the Dirac equation and the corresponding operators of the spinorial relativistic rotator (an indecomposable object lying on a mass-spin Regge trajectory). The analog of the Foldy-Wouthuysen transformation (more generally, the transformation between quasi-Newtonian and Minkowski coordinates) is constructed and explicit results are discussed for the spin and position operators. Zitterbewegung is shown to exist for a system having only positive energies. 31 references.

21228 (IFUSP-P—333) Flavour changing Higgs boson couplings and the electric dipole moment of the neutron. Escobar, C.O.; Pleitez, V. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1982. 7p. (IFT-P—06/82). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701066.

It is argued that the existence of flavour changing Higgs boson couplings, within the experimental bounds, is sufficient to increase by many orders of magnitude, the electric dipole moment of the neutron, in a model where CP violation occurs only in the weak charged current.

21229 (IFUSP-P—345) SU(2) x U(1) model with massive neutrinos and CP violation in the leptonic sector. Escobar, C.O.; Pleitez, V. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1982. 35p. (IFT-P—09/82). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701068.

An SU(2) x U(1) model incorporating massive neutrinos and CP violation for the leptons is examined. The model has Dirac and Majorana mass terms for the neutrinos and two doublets and one triplet of Higgs bosons. The implications of this model for the neutrino oscillations and for the electric dipole moment of the leptons are considered.

21230 (IFUSP-P—360) Anomaly free CP^1 model and its S-matrix. Abdalla, M.C.B.; Lima-Santos, A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Sep 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701026.

After showing that the CP^1 model factorizes the S-matrix is obtained for fundamental fields and bound states.

21231 (IFUSP-P—363) Higgs boson procduction in p-p sup(-) collisions at collider energies. Novaes, S.F. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Sep 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701069.

It is showned that the contribution of gluon fusion to Higgs boson production in proton-antiproton collisions is much smaller than what has been predicted before for large Higgs masses.

21232 (INIS-SU—198, pp 240) Ξ hypernuclei. Kolesnikov, N.N.; Zakharov, P.P.; Kolesov, A.V.; Tarasov, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21233 (TRI-PP—82-5) Are Higgs particles strongly interacting?. Shanker, O. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Feb 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701071.

The order of magnitude of Yukawa couplings in some theories with flavour violating Higgs particles is estimated. Based on these couplings, mass bounds for flavour violating Higgs particles are derived from the Ksub(L)-Ksub(S) mass difference. The Higgs particles have to be very heavy, implying that the Higgs sector quartic couplings are very large. Thus, these theories seem to re-

quire a strongly interacting Higgs sector unless one adjusts to the Higgs-fermion Yukawa couplings to within two orders of magnitude, so as to suppress the coupling of Higgs particles to the flavour-violating anti sd current. Most models with flavour violating Higgs particles have the same general features, so the conclusions are likely to hold for a wide class of models with flavour violating Higgs particles.

21234 **(TRI-PP—82-8) πl2, Kl3 and Ksup(o)-antiKsup(o) constraints on leptoquarks and supersymmetric particles.** Shanker, O. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Mar 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701072.

Mass bounds from different processes for charged Higgs particles, for pseudoscalar leptoquarks occurring in dynamically broken theories, for vector leptoquarks occurring in the Pati-Salam type of grand unified theories and for the exotic particles of supersymmetric theories are studied. The processes considered are the $\pi \rightarrow \nu$ to $\pi \rightarrow \mu\nu$ branching ratio, the CP-violating Kl3 decay parameters, and the CP-violating part of the Ksub(L)-Ksub(S) mass difference. The $\pi \rightarrow \nu$ to π $\mu\nu$ branching ratio sets the most stringent bounds, 0.5 TeV for charged Higgs particles, 1 Tev for pseudoscalar leptoquarks, 125 TeV for vector leptoquarks and 1 TeV for the supersymmetric partners of ordinary particles. The πl2 branching ratio should be sensitive at the present experimental accuracy to the effects of pseudoscalar leptoquarks.

21235 **(TRI-PP—82-11) Microscopic approach to sigma-hypernuclei.** Johnstone, J.A.; Thomas, A.W. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Apr 1982. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701088.

A separable potential model is constructed to describe the coupled the ΣN-ΛN systems. From this the Σ single-particle potential is developed including Pauli effects. The momentum-space Schroedinger equation is then solved self-consistently for the complex eigenvalues of ls and lp state light (A <= 16) Σsup(o) hypernuclei. Because of two distinct mechanisms these states are all found to be long-lived, with widths as small as 1.8 MeV in sub(Σsup(o))sup(5)He s-state, and 0.5 MeV in sub(Σsup(o))sup(9)Be p-state.

21236 **(TRI-PP—82-14) Thermodynamic limits of the quark plasma phase.** Boal, D.H.; Schachter, J.; Woloshyn, R.M. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Apr 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701070.

A model for the quark plasma phase at finite temperature and density is presented. The assumption that the effective interaction among quarks and gluons increases as density decreases is shown to lead naturally to a critical temperature around 220-300 MeV at zero chemical potential. The interpretation of this model in terms of phenomena expected in QCD is discussed.

21237 **Quark-gluon-plasma evolution in scaling hydrodynamics.** Gyulassy, M.; Matsui, T. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 3, 419-425(1 Feb 1984). Contract AC03-76SF00098.

The relation between the rapidity density of produced particles in ultrarelativistic nuclear collisions and the maximum proper energy density ϵ_0 is derived. The new scaling hydrodynamic equations of Bjorken, Kajantie, and McLerran are employed. The results exceed earlier estimates obtained with inside-outside cascade models and provide an independent estimate of ϵ_0 from collision data. We also derive a lower bound on ϵ_0 incorporating viscous heating and the first-order phase transition between the quark and hadronic phases. We infer that $\epsilon_0 > 2$ GeV/fm^3 can indeed be reached in the collision of heavy nuclei at cosmic-ray energies.

21238 **H dibaryon formation from Ξp atoms.** Aerts, A.T.M.; Dover, C.B. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 3, 433-443(1 Feb 1984). Contract AC02-76CH00016.

We estimate the branching ratio R for the formation of the doubly strange H dibaryon, starting from various states of Ξ^-p, Ξ^-d, and Ξ^- ^{4}He atoms. In the latter two cases, very sizable values of R>0.5 occur if the H mass is close to the $\Lambda\Lambda$ threshold at 2.23 GeV/c^2.

21239 **Quark-antiquark contribution to the hadroproduction of psi in the color-singlet model.** Clavelli, L.; Cox, P.H.; Harms, B. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 1, 57-62(1 Jan 1984). Contract W-31-109-ENG-38.

We consider the contribution to psi hadroproduction due to the elementary subprocess qq-bar→psiGG. The color-singlet nature and observed spin-parity of the psi are incorporated and the normalization of the cross section is predicted by the psi wave function at the origin as measured in the leptonic psi decay. We expect this process to dominate the difference in psi production from particle versus antiparticle beams. The energy dependence of psi production as well as distributions in x/sub F/ and P/sub T/ are predicted.

21240 **Partial rate differences from CP violation in hyperon nonleptonic decays.** Chau, L.L. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.); Cheng, H.Y. (Purdue Univ., Lafayette, IN (USA)). *Physics Letters,* [*Section*] *B;* **131**: No. 1-3, 202-208(10 Nov 1983).

The partial rate differences between particle and antiparticle into their corresponding CP conjugate states, e.g., Λ, Σ, >->πB, and anti Λ, anti Σ, anti >->πanti B, are estimated in the framework of the three left-handed-doublet model of Kobayashi and Maskawa using the current algebra methods. The CP-odd effects in general are very small.

21241 **Twist-four effects in electroproduction: model dependence.** Fajfer, S. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy); Oakes, R.J. (Fermi National Accelerator Lab., Batavia, IL (USA); Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy). *Physics Letters,* [*Section*] *B;* **131**: No. 1-3, 192-194(10 Nov 1983).

The twist-four, spin-two effects on the second Nachtmann moment in electroproduction have been calculated using the operator product expansion. To explore the model dependence of the nucleon matrix elements of the operators, proton and neutron wave functions from several different models of quark confinement were considered. While the twist-four, spin-two effects were indeed found to be substantially model-dependent, they were small (<=2%) in all cases, confirming the conclusions of Jaffe and Soldate, based on the MIT bag model.

21242 **Proton pole contribution in proton decay.** Thomas, A.W. (European Organization for Nuclear Research, Geneva (Switzerland)); McKellar, B.H.J. (Los Alamos National Lab., NM (USA). Theoretical Div.; Melbourne Univ., Parkville (Australia). School of Physics). *Nuclear Physics* [*Section*] *B;* **227**: No. 2, 206-220(24 Oct 1983).

Nucleon pole terms contribute significantly to proton decay, increasing the branching ratio for $e^+\pi^0$ and anti νsub(R)π^+ modes. The total lifetime is decreased to the point where keeping the SU(5) value of the lifetime below the experimental upper bound forces us to the choice of QCD scale parameter and proton radius parameter which are near the edge of the allowed region.

6453 Particle Invariance Principles And Symmetries

21243 **(DOE/ER/40008—56) Supersymmetry in physics: an algebraic overview.** Ramond, P. (Florida Univ., Gainesville (USA). Dept. of Physics). 1983. Contract AS05-81ER40008. 38p. (CONF-831267—2). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007289.

From Workshop on supersymmetry in physics; Los Alamos, NM, USA (15 Dec 1983).

In 1970, while attempting to generalize the Veneziano model (string model) to include fermions, I introduced a new algebraic

structure which turned out to be a graded Lie algebra; it was used as a spectrum-generating algebra. This approach was soon after generalized to include interactions, yielding a complete model of fermions and boson (RNS model). In an unrelated work in the Soviet Union, it was shown how to generalize the Poincare group to include fermionic charges. However it was not until 1974 that an interacting field theory invariant under the Graded Poincare group in 3 + 1 dimensions was built (WZ model). Supersymmetric field theories turned out to have less divergent ultraviolet behavior than non-supersymmetric field theories. Gravity was generalized to include supersymmetry, to a theory called supergravity. By now many interacting local field theories exhibiting supersymmetry have been built and studied from 1 + 1 to 10 + 1 dimensions. Supersymmetric local field theories in less than 9 + 1 dimensions, can be understood as limits of multilocal (string) supersymmetric theories, in 9 + 1 dimensions. On the other hand, graded Lie algebras have been used in non-relativistic physics as approximate symmetries of Hamiltonians. The most striking such use so far helps comparing even and odd nuclei energy levels. It is believed that graded Lie algebras can be used whenever paired and unpaired fermions excitations can coexist. In this overview of a tremendously large field, I will only survey finite graded Lie algebras and their representations. For non-relativistic applications, all of GLA are potentially useful, while for relativistic applications, only these which include the Poincare group are to be considered.

21244 **(IFT-P—10/82) Time symmetries involving magnetic monopoles.** Ferreira, P.L. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701027.

Time symmetries of a single particle system in the presence of a U(1) magnetic monopole are further discussed especially in connection with its quantization and related spectrum. Emphasis is directly given to the class of Lagrangians containing isotropic harmonic oscillator terms.

21245 **(IFUSP-P—318) Non-linear σ model with supergravity.** Abdalla, E.; Jasinschi, R.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jan 1982. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701003.

A locally supersymmetric version of the O(N) non-linear σ model within 1/N expansion scheme is studied, implying interesting features due to the mass generation.

21246 **(IFUSP-P—331) Non-local charge of the CP sup(n-1) model and its supersymmetric extension to all orders.** Gomes, M.; Abdalla, E.; Abdalla, M.C.B. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1982. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701005.

It is proved that the conservation of quantum non-local charge of the CP sup(n-1) model is spoiled by an anomaly calculable to all orders in the 1/n expansion while for its supersymmetric extension it is restored.

21247 **(IFUSP-P—348) Infrared divergences of the CP sup(n-1) models.** Cobra, B.B.; Gomes, M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701008.

Some properties of the two-dimensional SU(n) non-linear sigma models, i.e., the CP (sub n-1) models are discussed. They are 1/n expandable and ultraviolet renormalizable. The main result is a proof that the infrared divergences associated with the topological gauge field are cancelled in the case of Green functions of gauge invariant operators.

21248 **(TRI-PP—82-12) Symmetry-breaking patterns in SU(5) with non-minimal Higgs fields.** Kalyniak, P.; Ng, J.N. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Apr 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701028.

The symmetry-breaking patterns of Higgs fields in an adjoint and 45-dimensional representation of SU(5) are found, and differences with the 5-dimensional representation case are studied in detail.

21249 **General supersymmetric equations involving unconstrained chiral superfields.** Catto, S.; Guersey, F. (A.W. Wright Nuclear Structure Laboratory and J.W. Gibbs Laboratory, Yale University, Physics Department, New Haven, Connecticut 06511). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 4, 653-657(15 Feb 1984). Contract AC02-76ER03074.

Four-dimensional second-order supersymmetric equations involving an arbitrary function of an unconstrained chiral superfield are proposed. In three dimensions a new invariant operator provides the generalization of analogous two-dimensional equations that are of first order in the fermion field.

21250 **Dynamical gauge-symmetry breaking and left-right asymmetry in higher-dimensional theories.** Hosotani, Y. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510 and Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 4, 731-738(15 Feb 1984). Contract AC02-76ER03071.

We examine dynamical gauge-symmetry breaking and left-right asymmetry in higher-dimensional theories by taking non-Abelian gauge theory on a manifold $M^2 \times S^2$, where M^2 and S^2 are a two-dimensional Minkowski space and a two-sphere, respectively. It is shown that a shift in fermion zero-point energies due to the compactness of the extra-dimensional space S^2 induces dynamical gauge-symmetry breaking, provided that there exist many heavy fermions. With additional Weyl fermions incorporated in $M^2 \times S^2$ we obtain left-right—asymmetric massless fermions in M^2. The effective Lagrangian in M^2 is given. A relationship between four-dimensional and two-dimensional anomalies is also established.

21251 **Supersymmetry breaking at finite temperature: The Goldstone fermion.** Boyanovsky, D. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 4, 743-751(15 Feb 1984). Contract AC03-76SF00515.

In this paper it is shown that supersymmetry is broken at any finite temperature. The current-algebra relations that indicate the presence of a Goldstone fermion are generalized to finite temperature in the real-time formalism. The existence of a massless pole in fermionic thermal Green's functions is thus predicted. Explicit calculations in several models confirm the existence of this Goldstone fermion at finite temperature. It is found that the residue at the p/sub μ/ = 0 pole vanishes as the temperature goes to zero.

21252 **Some general properties of the O(α) corrections to parity violation in atoms.** Marciano, W.J.; Sirlin, A. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 1, 75-88(1 Jan 1984). Contract AC02-76CH00016.

The model-dependent contributions to the parity-violating electron-nucleon interaction arising from γZ box diagrams are discussed on the basis of a formulation in which the hadronic parts of the amplitude are treated exactly ab initio. This leads to a derivation of general properties and more refined estimates of these effects. A method to take into account the large-distance part of the hadronic contributions to the γZ mixing diagrams using experimental information on $e^+ + e^- \rightarrow$hadrons is briefly discussed. Predictions for the C/sub i/N (i = 1,2, N = p,n) are updated taking into account the more detailed estimates of this paper.

6454 Field Theory

REFER ALSO TO CITATION(S) 21239, 21243, 21248, 21249, 21250, 21251, 21453

21253 **(CBPF-NF—014/82) Gravitational coupling of neutrinos to matter vorticity II: microscopic asymmetries in angular-momentum modes.** Soares, I.D.; Rodrigues, L.M.C.S. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701024.

The gravitational coupling of neutrinos to matter vorticity is examined; in the context of the Einstein's theory of gravitation and for technical simplicity considered the Goedel model as the gravitational background, whose matter content has a non-null vorticity has been considered. Dirac's equation is solved by separation of the neutrino amplitudes into invariant angular-momentum and energy modes. These modes provide two distinct representation bases for the algebra of the total angular momentum of the system (one finite-dimensional and the other infinite-dimensional). The presence of a vorticity field of matter generates, via gravitation, microscopic asymmetries in neutrino physics. The angular momentum space appears to be polarized along the direction determined by the local vorticity field Ω sup(→). At the microscopic level, currents are asymmetric along the direction determined by the vorticity field: Neutrino (anti neutrino) currents are larger along the direction antiparallel (parallel) to the vorticity field. In the case of production of pairs under CP violation a net number asymmetry may be generated between neutrinos and antineutrinos.

21254 **(CBPF-NF—030/83) Effective potential using unconstrained chiral superfield propagators.** Srivastava, P.P. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700994.

S. Weinberg's tadpole method is implemented to calculate the effective potential in supersymmetric theories using superfield formulation. The simplified unconstrained chiral superfield propagators found recently where the mass parameters are constant chiral superfields render the computation very simple in the case of Wess-Zumino model considered here as an illustration even in higher loops.

21255 **(CBPF-NF—037/82) Simple interpolation for high and low momentum transfers in QCD.** Mignaco, J.A.; Roditi, I. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700995.

It is shown that a simple rational approximation for the function $\beta(g)$ of the renormalization group provides a useful expansion parameter for the perturbative regime in QCD and, simultaneously, allows for confinement the functional integral approximation to this problem.

21256 **(CBPF-NF—043/82) Wilson loops and constant gauge fields.** Bollini, C.G.; Giambiagi, J.J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700998.

The Wilson loop averaged over the class of constants gauge fields in two dimensions for SU(N), with N large is computed. The limit N → infinite gives asymptotically the area law. The case of three dimensions is discussed.

21257 **(UFRJ-IF—03/83) Field generated by torsion in a four-dimensional Weitzenboeck space.** Oliveira, C.G.; Amaral, C.M. do. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701011.

The field generated by torsion in a four-dimensional Weitzenboeck space is considered. This field is interpreted as a dynamical system with a quadratic Lagrangian density of the Yang-Mills form. The interaction with a spin 1/2 Dirac field is treated. The linear approximation for the free field generated by torsion is studied.

21258 **(UFRJ-IF—11/83) Static combined conformally invariant scalar field and electromagnetic field.** Accioly, A.J.; Vaidya, A.N.; Som, M.M. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701015.

The problem of the combined electromagnetic and conformally invariant scalar fields in a space-time admitting isometries along t, y and z axis is completely solved. The solution involves three parameters K_1, K_2 and K_3 which are related to the scalar, electric and gravitational charges respectively. One can obtain the vacuum solution, the pure scalar field and the pure electromagnetic field solutions in a straightfoward way with the help of the three parameters.

21259 **(UFRJ-IF—12/83) Bianchi type-I model with conformally invariant scalar and electromagnetic field.** Accioly, A.J.; Vaidya, A.N.; Som, M.M. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701016.

A Bianchi type-I exact solution of the Einstein theory representing the homogeneous anisotropic models with the electromagnetic field and the conformally invariant scalar field is studied. The solution contains Kasner model, pure electromagnetic and pure scalar models as special cases. It is found that the models evolve from an initial Kasner type to a final open Friedmann type universe.

21260 **(UFRJ-IF—13/83) Static electromagnetic field.** Accioly, A.J.; Vaidya, A.N.; Som, M.M. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701017.

The problem of static electromagnetic field admitting a time-like and two space-like Killing vectors is completely solved. The solutions contain plane-symmetric solution as a special case. The solutions can be transformed into solutions describing the gravitational field of a charge line-mass by suitably introducing weyl's canonical coordinates. Further, these solutions are true generalizations of Kasner solutions.

21261 **(UFRJ-IF—17/83) Stationary cylindrically symmetric non-minimally coupled scalar field.** Accioly, A.J.; Vaidya, A.N.; Som, M.M. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701019.

The problem of a conformally invariant scalar field coupled with the gravity has been completely solved in the stationary cylindrically symmetric case. The solutions resemble those given by van Stockum for the Lewis metric. For suitable values of the constants, the azimuthal coordinate lines (phi-lines) are not closed. The expressions of the mass/length and the angular momentum/length of the system are obtained.

21262 **Link fermions in Euclidean lattice gauge theory.** Brower, R.; Giles, R.; Maturana, G. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 4, 704-715(15 Feb 1984). Contract AC02-76ER03069.

The representation of the Wilson lattice fermion propagator as a sum over classical particle trajectories is discussed. A simple generalization of this path sum leads to an extended set of fermion theories characterized by one (or more) additional parameters. Such theories are nonlocal when written in terms of the usual four-component Dirac field. They are more naturally characterized by a local action functional whose degrees of freedom are those of a set of two-component Fermi fields defined on directed links of the lattice. Such lattice fields correspond to the direct product of a four-vector and Dirac spinor. For a suitable choice of parameters, the extended fermion theory offers a precocious approach to the continuum dispersion relation as the lattice spacing goes to zero and is therefore of interest for numerical studies of QCD.

21263 **Stability properties of an Abelianized chromoelectric flux tube.** Flory, C.A. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 4, 722-730(15 Feb 1984). Contract AC03-76SF00515.

The quantum fluctuations about a uniform chromoelectric field confined to a cylindrical region are computed. The effective Lagrangian determined from this procedure yields the following interesting results. (1) The chromoelectric flux contained in this region must be less than a calculable critical value to preclude the existence of unstable fluctuation modes which would render the calculation ill-defined. (2) At a flux below this critical value, the fluctuations tend to make it energetically favorable for the flux tube to collapse upon itself. (3) Making analogies between this chromoelectric flux-tube model and physical hadronic strings, we estimate

that the string of flux in a physical QQ-bar hadronic system is well within the region of stability. However, if the quark charges are increased by a factor of roughly 3, the string would become unstable by the above mechanism. This is given as an argument against the existence of certain exotic quark states.

21264 **Nonconfinement at high temperatures.** Tomboulis, E.; Yaffe, L. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08544 and Physics Department, University of California, Los Angeles, California 90024). *Physical Review [Section] D: Particles and Fields;* **29**: No. 4, 780-782(15 Feb 1984). Contract AC02-76ER03072.

SU(2) lattice gauge theories in two or more space dimensions with any value of the bare coupling are shown rigorously to possess a nonconfining phase at sufficiently high temperature.

21265 **Flavor thresholds and Λ in the modified minimal-subtraction scheme.** Marciano, W.J. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **29**: No. 3, 580-582(1 Feb 1984). Contract AC02-76CH00016.

A discussion of the modified minimal-subtraction (MS) prescription in QCD is presented. Effects of flavor thresholds on α/sub s/(μ) and Λ/sub MS/ are examined. Two parametrization options are described. In the first approach, distinct mass scales Λ/sub MS//sup(N//sub F/) associated with N/sub F/, the effective number of flavors are introduced. In the second scheme, a standard N/sub F/-independent Λ/sub MS/ is adopted but the functional form of α/sub s/(μ) is slightly modified.

21266 **Simulation of euclidean quantum field theories by a random walk process.** Stamatescu, I.O.; Wolff, U. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik); Zwanziger, D. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; New York Univ., NY (USA)). *Nuclear Physics [Section] B;* **225**: No. 3, 377-390(28 Nov 1983). (CONF-821253—).

From Topical meeting on progress in the solution of quantum gauge theories; Trieste, Italy (17 Dec 1982).

A new Monte Carlo method for euclidean lattice field theory is introduced by writing the Boltzmann distribution esup(-s) as solution of a diffusion type equation and constructing the associated random walk process. It is practically tested for a quantum mechanical model and a non-compact version of lattice QCD. It is explained where the main interest in this algorithm lies: the diffusion process coming from an action that can be generalized to include non-conservative forces. This possibility is exploited in our QCD version to implement gauge fixing without Faddeev-Popov ghosts.

21267 **Comments on glueballs, multi-quark states and the OZI rule.** Lindenbaum, S.J. (Brookhaven National Lab., Upton, NY (USA); City Coll., New York (USA)). *Physics Letters, [Section] B;* **131**: No. 1-3, 221-223(10 Nov 1983).

Arguments in regard to the OZI rule by Lipkin are shown to be erroneous, especially in regard to the reaction $\pi^- p \rightarrow$ phiphin and psi'(3685)->J/psi(3100)+2π which he concludes are OZI allowed or only suppressed by a much smaller factor. His conclusions in regard to our glueball arguments are also erroneous. The reasons for these errors are discussed in this paper.

21268 **Wilson loops for U(4) and SU(4) lattice gauge theories in four dimensions.** Barkai, D. (Colorado State Univ., Fort Collins (USA). Center for Applied Vector Technology); Creutz, M. (Brookhaven National Lab., Upton, NY (USA)); Moriarty, K.J.M. (European Organization for Nuclear Research, Geneva (Switzerland)). *Nuclear Physics [Section] B;* **225**: No. 1, 156-168(3 Oct 1983).

Monte Carlo simulations are used to calculate Wilson loops for pure U(4) and SU(4) gauge theories on a 6^4 lattice. The first-order phase transitions previously observed in the average action per plaquette for U(4) and SU(4) is also seen in the string tension. U(4) and SU(4) color seem to be confined while U(1) charge in U(4) appears to be deconfined.

21269 **U(N) and SU(N) lattice gauge theories, in the weak-coupling region, in four dimensions.** Creutz, M. (Brookhaven National Lab., Upton, NY (USA)); Moriarty, K.J.M. (Colorado State Univ., Fort Collins (USA). Inst. for Computational Studies). *Journal of Physics G: Nuclear Physics;* **9**: No. 10, L207-L210(Oct 1983).

Monte-Carlo simulations on a 6^4 lattice are employed to calculate the 1 x 1 Wilson loops W(1,1) and the associated string tension for pure U(N) and SU(N), N=2,3,4,5 and 6, gauge theories in the weak-coupling region. It is shown that U(N)→SU(N) as N increases, with U(6)approx.= to SU(6).

6455 Scattering Theory

REFER ALSO TO CITATION(S) 21454

65 PHYSICS. II.

21270 **(INIS-mf—8703) Seventh conference of Czechoslovak physicists. Part 1. Vol. 1.** (Jednota Ceskoslovenskych Matematiku a Fyziku, Prague). 1981. 174p. (In Czech). (CONF-8108164—Pt.1-Vol.1). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780103.

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

Separate entries were made in the data base for the in scope papers presented. (WHK)

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 20622

21271 **(DOE/ER/10418—T4) Light particle emission measurements in heavy ion reactions. Progress report.** Petitt, G.A. (Georgia State Univ., Atlanta (USA). Dept. of Physics and Astronomy). 1984. Contract AS05-79ER10418. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008349.

Progress on the study of neutron and charged particle emission in heavy ion reactions using the facilities at the HHIRF is briefly described. Instrumentation development is discussed including work on positin sensitive neutron detectors, a new target chamber, and an evaporation residue detector for fusion reactions. Neutron emission in fusion-fission reactions and charged particle emission in the O + Nb reaction were studied. Other work in progress is discussed. (WHK)

21272 **(INIS-mf—8324) Institut fuer Strahlen- und Kernphysik der Universitaet Bonn: Annual Report 1981-1982.** Jahn, R.; Guenther, C. (ed.). (Bonn Univ. (Germany, F.R.). Inst. fuer Strahlen- und Kernphysik). 1982. 168p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780118.

This annual report contains extended abstracts about the work done at the named institute together with a list of publications. The work concerns nuclear reactions, fission, nuclear moments, electron and gamma spectroscopy, ion-solid interactions, archeometry, electric and magnetic hyperine fields, as well as experimental techniques.

21273 **(INIS-SU—198) Summaries of reports of 23. conference on nuclear spectroscopy and nuclear structure.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow; Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow; Moskovskij Gosudarstvennyj Univ. (USSR)). 1983. 601p. (In Russian). (CONF-8304144—Summs.). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104.

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

The papers presented were entered into the data base separately. (WHK)

21274 **(KEK—81-23) Proceedings of the workshop on physics with 12 GeV PS at KEK.** Kajikawa, R.; Nakai, K.; Sasao, N.; Masaike, A.; Sato, T. (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Mar 1982. 86p. (CONF-8103183—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780110.

From Workshop on physics with 12 GeV PS at KEK; Oho, Ibaraki, Japan (9 Mar 1981).

The papers presented were entered into the data base separately. (WHK)

21275 **(NEANDC—172-U) Summary record of the twenty-third meeting, (technical sessions), Chalk River, Canada, 27 Sep - 1 Oct 1982.** Qaim, S. (Nuclear Energy Agency, 75 - Paris (France). Nuclear Data Committee). [nd]. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700729.

The technical sessions deal with advances in nuclear data measurements and newer facilities (with special attention paid to data for fission and fusion reactors); advances in nuclear data evaluations (regional activities and joint evaluated file); activities of nuclear data centres; report on recent NEA meetings; subcommittee reports.

21276 **(NEANDC(E)—233-U) Rapport d'activites pour l'annee 1981. Travaux relatifs au donnees nucleaires en France.** Frehaut; Michaudon. (Nuclear Energy Agency, 75 - Paris (France). Nuclear Data Committee). [nd]. 62p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700725.

The work carried out in the nuclear research centers of Cadarache, Bruyeres-le-Chatel and Grenoble are reported. Data on neutron cross sections (total, capture, fission, scattering) and nuclear decay are given.

6511 Experimental Techniques

21277 **(IFUSP-P—346) Counting the peaks in the excitation function for precompound processes.** Bonetti, R.; Hussein, M.S.; Mello, P.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701007.

The 'counting of maxima' method of Brink and Stephen, conventionally used for the extraction of the correlation width of statistical (compound nucleus) reactions, is generalized to include precompound processes as well. It is found that this method supplies an important independent check of the results obtained from auto-correlation studies. An application is made to the reaction $^{25}Mg(^{3}He,p)$.

6512 Nuclear Properties And Reactions, A=1-5, Theoretical

21278 (INIS-mf—8703, pp vp) **Measurement of deuteron binding energy.** Adam, J.; Hnatowicz, V.; Kugler, A. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21279 (INIS-SU—198, pp 241) **Meson decays of hypertritium.** Kolesnikov, N.N.; Kopylov, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21280 (INIS-SU—198, pp 300) **Analysis of two-fold differential cross sections for particle (A<4) emission in terms of the microscopic model of pre-equilibrium nuclear reactions.** Deb, A.K.; Zhivopistsev, F.A.; Kabin, Eh.I.; Sukharevskij, V.G.; Khajmin, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21281 (INIS-SU—198, pp 413) **Potential effects in the neutron + ^{3}He system.** Levashev, V.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21282 (INIS-SU—198, pp 416) **p^{3}He elastic backscattering at intermediate energies.** Zhusupov, M.A.; Uzikov, Yu.N.; Yuldasheva, G.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21283 (INIS-SU—198, pp 417) **Calculation of cross section of total electrodisintegration of the ^{3}He nuclei in an interpolation model.** Kobrinskij, Yu.V.; Tartakovskij, V.K. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21284 (INIS-SU—198, pp 419) **Weak neutral currents and P odd effects in the deuteron electrodisintegration.** Rekalo, M.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21285 (INIS-SU—198, pp 421) **Accounting for a triangular diagram for the n + T → n + T process in K matrix calculations of scattering in a four-nucleon system.** Baryshnikov, A.G.; Blokhintsev, L.D.; Krekoten', S.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21286 (INIS-SU—198, pp 441) **Investigation of inclusive spectra of nuclear reaction products with participation of deuterons and ^{3}He nuclei at intermediate energies.** Evlanov, M.V.; Polozov, A.D.; Sokolov, A.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21287 (INIS-SU—198, pp 449) **Calculation of elastic scattering lengths of proton on deuteron with account for the Coulomb interaction.** Zepalova, M.L. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21288 (INIS-SU—198, pp 450) **Calculation of the ^{3}He(d,p)pT reaction in the range of small relative energy of proton and triton.** Dubovoj, Eh.I.; Kertkoev, Eh.F. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21289 (INIS-SU—198, pp 452) **Scattering of positive kaons on the ^{2}H, ^{3}He and ^{4}He nuclei.** Baryshnikov, A.G.; Blokhintsev, L.D.; Krekoten', S.P.; Safronov, A.N. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21290 (INIS-SU—198, pp 454) **Realistic deuteron wave functions in the elastic e-d scattering and dependence on nucleon form factors.** Belyantsev, I.I.; Mitryushkin, V.K.; Rashidov, P.K.; Trubnikov, S.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21291 **(JAERI-M—83-006) Evaluation of neutron nuclear data for deuterium.** Shibata, Keiichi; Narita, Tsutomu; Igarasi, Sin-iti. (Japan Atomic Energy Research Inst., Tokyo). Feb 1983. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700720.

Evaluation of neutron nuclear data for ^{3}H has been performed in the neutron energy region from 10^{-5} eV to 20 MeV. The evaluated quantities are the total, elastic scattering, capture and (n, 2n) reaction cross sections, the angular distribution for the elastic scattering and the double-differential cross section for the (n, 2n) reaction. Theoretical calculations were done of the elastic angular distribution and the neutron spectrum from the (n, 2n) reaction on the basis of the Faddeev equation. The present evaluated data are compiled in the ENDF/B format and to be stored in the second version of Japanese Evaluated Nuclear Data Library, JENDL-2.

21292 **(TRI-PP—82-13) Parametrization of the nucleon-trinucleon overlap function in ^{4}He and the effect of meson exchange corrections.** Greben, J.M. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Apr 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701089.

Nucleon-trinucleon overlap functions in ^{4}He have been parametrized as a sum of exponentials, and are fitted to the charge form factor of ^{4}He. We present results with and without taking account of meson-exchange corrections.

21293 **(IFUSP-P—327) Calculation of B(E2) for the ^{18}F.** Almeida, F.I.A. de; Carlin Filho, N.; Chen, Y.T.; Coimbra, M.M.; Takai, H.; Mastroleo, R.C.; Silveira, L.A.; Villari, A.C.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Mar 1982. 18p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701080.

A detailed calculation of the reduced probability of transition B(E2) for ^{18}F, utilizing a simple model and the nucleon-nucleon interaction matrix given by Kuo-Brown is presented. In spite of the simplicity of the model, the results are satisfactory and are compared with the experimental data and other author calculations.

21294 **(INIS-mf—8309) (p,^{3}He) reactions on 1p shell nuclei at 41 and 45 MeV.** Rapp, V. (Tuebingen Univ. (Germany, F.R.). Fakultaet fuer Physik). 14 Jul 1982. 107p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780117.

In the present thesis the (p, ^{3}He) reactions on target nuclei of the 1p shell were studied. The measurements were performed at the isochronous cyclotron of the KFA Juelich. Angular distribution at 41 and 45 MeV to residual nuclear states in ^{7}Li, ^{8}Be, ^{9}Be, ^{10}B, ^{11}B, ^{13}C, ^{13}C, and ^{14}N. were evaluated.

21295 (INIS-SU—198, pp 427) **Analysis of neutron scattering on the ^{6}Li and ^{12}C nuclei according to the microscopic model.** Gulyamov, M.G.; Bekbaev, S.M.; Kim, G.; Islomov, Z.R. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21296 (INIS-SU—198, pp 436) **Sensitivity of the T matrix approximetion in (p,2p) reactions to distorted wave parameters.** Vdovin, A.I.; Golikov, I.G.; Loshchakov, I.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21297 (INIS-SU—198, pp 437) **Accounting for Fresnel corrections in a dynamic theory of quasi-elastic knock-out of clusters from nuclei by fast hadrons.** Golovanova, N.F.; Iskra, V.; Kurovskij, V.V.; Polozov, A.D. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21298 (INIS-SU—198, pp 438) **Analogue of an optical theorem in inclusive description of knock-out reactions.** Zavarzina, V.P.; Sergeev, V.A.; Stepanov, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21299 (INIS-SU—198, pp 439) **Effect of fast particle rescattering on cumulative fragment spectra.** Galanina, L.I.; Zelenskaya, N.S. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21300 (INIS-SU—198, pp 442) **Spectroscopy of α-cluster states and an angular (α-d) correlation function in the distorted wave method.** Gridnev, K.A.; Omer, Kh.M.; Semenov, V.M.; Subbotin, V.B. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21301 (INIS-SU—198, pp 465) **Knock-out of nucleons from nuclei by nucleons.** Ismatov, E.I.; Tartakovskij, V.K.; Cherdnichenko, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21302 **(JAERI-M—82-117) Neutron yields from bombardment of α-particles.** Nakasima, Ryuzo. (Japan Atomic Energy Research Inst., Tokyo). Sep 1982. 72p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700718.

The thick target neutron yields from bombardment of <10 MeV α-particles are calculated based on the reaction cross sections. The results for the elements of $Z < 15$ are compared with existing calculated or measured neutron yield data. For the elements of $16 < Z < 50$, elemental or isotopic neutron yields are calculated if the cross section data are available.

21303 **(KURRI-TR—227) Study on ^{9}Be(γ, n) reaction.** Fujishiro, M.; Tabata, T.; Satoh, Y.; Furuta, J.; Okamoto, K. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 3 Apr 1982. 23p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700723.

In chapter 1 are described measurements of cross sections σ(E sub(γ)) of the ^{9}Be(γ, n) reaction with six kinds of radioisotopes. The results were $\sigma(1674.7) = 8.8 +- 1.6$, $\sigma(1705.2) = 13.3 +- 2.4$, $\sigma(1724.9) = 11.0 +- 2.0$, $\sigma(1778.9) = 7.3 +- 1.3$, $\sigma(1836.0) = 4.7 +- 0.9$, and $\sigma(2167.6) = 1.8 +- 0.4$ in unit of 10^{-28} cm^{2}. The cross sections measured show a cusp-like peak near the threshold, and its width is narrower than that observed by Jakobson with bremsstrahlung X-rays. Comparison of the present results with theories indicates that mutual agreement is yet qualitative. In chapter 2 is described a measurement of the intensity I(2009.8) of the crossover E4 transition in ^{46}Ti by applying the ^{9}Be(γ, n) reaction. The observed intensity per decay of ^{46}Sc was $I(2009.8) = (1.2 +- 0.7) \times 10^{-7}$. From the present result the reduced transition probability B(E4) of the crossover E4 transition between the 2009.8 keV, 4^{+} excited state and the 0^{+} ground state of ^{46}Ti was estimated as $B(E4) = (5.2 +- 3.7) \times 10^{-99}$ e^{2}.cm^{8}. Discussion was given of the presently measured intensity and of nuclear models.

21304 **(UFRJ-IF—13/82) Study of α-^{16}O scattering by orthogonality condition models.** Breitschaft, A.M.; Canto, L.F.; Schechter, H. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1982. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701085.

The use of approximate microscopic theories in α-^{16}O scattering is investigated. The Orthogonality Condition Model (OCM) with the direct potential of the Resonating Group Method (RGM) and with an effective local potential V sub(eff') derived from Kernels of the Generator Coordinate Method (GCM) is employed to study collisions at CM energies up to 30 MeV, for all relevant partial waves. Although the predictions of the OCM are consistent with 'exact' RGM results in both cases, the nuclear phase-shifts obtained with the effective potential are better. It is noticed the presence of ambiguities in the derivation of V sub(eff'). The nature of such ambiguities is discussed.

21305 **Low energy p-bar-nucleus reaction cross sections.** Cohn, H.O.; Brau, J.E.; Bugg, W.M.; Condo, G.T.; Handler, T.; Hart, E.L. (Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review [Section] C: Nuclear Physics;* **29**: No. 1, 332-332(Jan 1984). Contract W-7405-ENG-26.

Measurements of the reaction cross sections for ~70 MeV (laboratory kinetic energy) antiprotons on lead and carbon are presented. Although lacking great statistical authority, the large observed cross sections suggest that the low energy reaction cross sections increase rapidly at lower energies above the Coulomb barrier.

21306 **Single nucleon pickup reactions in light nuclei.** Woods, C.L. Oxford, England; Oxford University (1981). 242p. British Library, Boston Spa, Wetherby, West Yorks. No. D45107/83.

Angular distributions have been measured for the elastic and inelastic scattering of ^{6}Li from ^{12}C, ^{16}O and ^{26}Mg at 36 MeV, ^{7}Li from ^{11}B at 22.34 MeV, ^{7}Li from ^{15}N at 28.8 MeV and ^{7}Li from ^{25}Mg at 27 MeV. An optical model analysis of the elastic scattering produced equally good results using either Woods-Saxon or double-folding model potentials. The double-folding potentials required normalization by factors of between 0.5 and 0.8 to reproduce the data. The analysis suggested that the gradient as well as the normalization of these potentials may be incorrect at the strong absorption radius. Collective model DWBA analyses of the inelastic scattering to the first excited states of ^{12}C and ^{26}Mg have been performed. Values of 0.62 and 0.38 were obtained for the deformation parameters of the ground state rotational bands in ^{12}C and ^{26}Mg respectively. Coupled-channels analyses of these data were performed and a comparison of the results with those of the DWBA analyses indicated that a coupled-channels calculation was only necessary for ^{12}C. Angular distributions for the ^{26}Mg(^{6}Li,^{7}Be)^{25}Na, ^{16}O(^{6}Li,^{7}Be)^{15}N and ^{12}C(^{6}Li,^{7}Be)^{11}B reactions, with the ejectile in its ground and first excited states, have also been measured at an incident energy of 36 MeV. Exact finite range DWBA analyses of the ^{26}Mg,^{16}O(^{6}Li,^{7}Be) reactions have been performed.

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21307 **(IFUSP-P—338) Effect of two-step α transfer reaction in the elastic scattering of ^{12}C+^{24}Mg.** Lichtenthaler Filho, R.; Lepine-Szily, A.; Villari, A.C.C.; Mittig, W.; Porto, V. de J.G.; Acquadro, C.V. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jun 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701084.

Angular distribution of the elastic scattering ^{24}Mg(^{12}C,^{12}C)^{24}Mg and of the ^{24}Mg(^{12}C,^{16}O)^{20}Ne transfer reaction have been measured at 40 MeV incident energy, respectively in the 20° <= theta sub(CM) <= 115° and 20° <= theta sub(CM) <= 60° angular regions. The elastic scattering and transfer reactions were analysed with Frahn's closed formalism as well as with optical model calculations. The influence of the two-step α-transfer channel (^{12}C+^{24}Mg → ^{16}O+^{20}Ne → ^{12}C+^{24}Mg) on the elastic scattering was calculated explicitly using the coupled channel extension of the closed formalism. This calculation shows that the coupling between the α-transfer and elastic channel can account for the intermediate angle oscillations observed in the elastic scattering angular distributions.

21308 (INIS-mf—8703, pp vp) **Nonstatistical effects in the structure of ^{29}Si(d,p)^{30}Si excitation curves.** Burjan, V.; Kroha, V. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21309 (INIS-SU—198, pp 430) **Semimicroscopic description of photodisintegration of ^{32}S.** Ishkhanov, B.S.; Kanzyuba, V.G.; Kapitonov, I.M.; Orlin, V.N.; Shvedunov, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21310 (KEK—81-23, pp 46-52) **Nuclear reactions in a few GeV region.** Nakai, Koji (Tokyo Univ. (Japan). Faculty of Science). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. (CONF-8103183—).

From Workshop on physics with 12 GeV PS at KEK; Oho, Ibaraki, Japan (9 Mar 1981).

The preliminary results of hadron-nucleus experiments performed by KEK-πAC group at KEK are reported. The production cross sections of compound particles (p, d, ^{3}He, ^{4}He) in the collision of 12 GeV protons and various kinds of nuclei (Al, Cu, Ag, Ta) were measured. The data were analysed using the model by Sato and Yazaki. The result indicated that the spread of the source of production was independent of the size of target nuclei, and was small as compared with the latter. The reactions of nuclei with protons and pions at 1 -- 4 GeV were also studied. The data have been partly analysed. It was found that in some events, the charged particles were emitted in clusters, which suggest the localization of the reactions. The multiplicity cross sections indicated that the low multiplicity (M <= 3) events were caused by peripheral collision, while the high multiplicity (M >= 4) events were due to the central process. It was found that the mean multiplicity and the multiplicity distribution in M >= 4 have scaled as a function of the kinetic energy of incident particles. In the spectra of protons obtained by a ΔE-E telescope, the contribution from vaporing process at low energy as well as that from the so-called pre-equilibrium process at 70 -- 80 MeV was seen. The experiment to study on the spectra of the particles emitted forward is planned.

21311 (ZfK—491, pp 22-31) **Preequilibrium emission in the reaction ^{14}N + ^{27}Al at 100 MeV.** Billerey, R.; Cerruti, C.; Chevarier, A.; Chevarier, N.; Cheynis, B.; Demeyer, A.; Stern, M.; Namboodiri, M.N. (Lyon-1 Univ., 69 (France)). Dec 1982. NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

Several studies of heavy ion reactions have been made recently in which light particle-heavy fragment coincidence techniques have been employed to explore the existence of non-equilibrium phenomena. The results obtained on the ^{14}N + ^{27}Al system at 100 MeV incident energy are reported. The measurements have been performed at the isochronous cyclotron of the Institut des Sciences Nucleaires at Grenoble. The schematic feature of the preequilibrium emission is given. The experimental data and their analysis is pp = split in three parts: reaction mechanisms observed in N + Al system, preequilibrium emission in fusion and deep inelastic process.

21312 **(INIS-mf—8304) Measurement of the circular polarization of gamma radiation from heavy ion collisions.** Lauterbach, C. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 30 Jul 1981. 203p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780116.

For the nuclear reactions $^{16}O + ^{27}Al$, $^{16}O + ^{58}Ni$, $^{16}O + ^{62}Ni$, ^{40}Ar + sup(nat)Ag, ^{86}Kr + sup(nat)Ag, and $^{86}Kr + ^{197}Au$ at incident energies of about 7 MeV/nucleon the circular polarization of the γ radiation emitted by the reaction products was measured. The projectile - like reaction products were detected by a ΔE-E telescope at a fixed angle of 35° relative to the beam axis. It is shown that the sign of the scattering angle for the classical orbit of the reaction partners can be determined by the experimental detection of circularly polarized γ-radiation from the decay of the highly excited reaction products. In the performed experiments for the first time extensive polarization phenomena in deep inelastic reactions were observed. The dominance of negative scattering angles was verified for a large range of light and medium-heavy systems. The results are compared with the predictions of theoretical models in which statistical or quantum mechanical fluctuations of the dynamical quantities are regarded.

21313 (INIS-SU—198, pp 309) **Calculation of angular distributions of γ-quanta from the (n, nsup(')γγ) and (n,nsup(')γγγ) reactions on ^{56}Fe and ^{208}Pb.** Dzyuba, B.M.; Lazarev, L.M.; Paramonova, I.N.; Savin, M.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21314 (LA—9974-T) **Pion elastic and inelastic scattering from $^{40\ 42\ 44\ 48}Ca$ and ^{54}Fe.** Boyer, K.G. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 402p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84009080.

Portions are illegible in microfiche products. Original copy available until stock is exhausted; Thesis. Submitted to Univ. of Texas, Austin.

Differential cross sections were measured for pion elastic and inelastic scattering from $^{40\ 42\ 44\ 48}Ca$ and ^{54}Fe at T/sub π/ = 116.0, 180.0, and 292.5 MeV. The ground states were analyzed using a Kisslinger potential with and without free parameters. The low-lying collective states were analyzed using a distorted wave impulse approximation with no free parameters and transition densities obtained from electron and proton scattering data. These analyses adequately reproduced the pion scattering data. Ground-state neutron density rms radii were estimated and compared with a theoretical calculation and analyses of proton, alpha, pion, and pionic x-ray data. Proton and neutron multipole matrix elements were extracted from the 2_1^+ and 3_1^- states in $^{42\ 44\ 48}Ca$ and compared with tabulated electromagnetic matrix elements. Model-dependent errors are examined by comparing the results of calculations using collective-model form factors with those using form factors fitted to electron and proton scattering data. 69 references.

21315 (LUIP—8314) **Mean free path of relativistic fragments from heavy ion reactions by 1.8 A GeV ^{40}Ar in low sensitive nuclear emulsions. Banaras - Chandigardh - Jaipur - Jammu - Lund collaboration.** Beri, S.B.; Bhalla, K.B.; Bhanja, R. (Lund Univ. (Sweden). Dept. of Cosmic and Subatomic Physics). Aug 1983. 16p. (LUNFD6/NFFK—7037/1-11(1983)). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700724.

Preliminary data is given for the mean free path of projectilelike fragments, $2<Z<18$, emitted in ^{40}Ar induced heavy ion reactions in nuclear emulsions at 1.8A GeV as well as in later generations of fragmentation chains. Only within a distance of one cm or less from the interaction point do we observe an enhanced collision frequency. If this observation is a signal of an anomalous fragmentation component this must have a very short mean free path or a lifetime less than 10^{-11}s. Some suggestions are given for systematic or statistaical effects which could also possibly explain our results.

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21316 (IFUSP-P—341) **Electrodisintegration of ^{63}Cu and ^{65}Cu.** Martins, M.N.; Wolynec, E.; Campos, M.C.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1982. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701033.

The (e,α) cross section for ^{65}Cu has been measured in the electron energy range 14-34 MeV. The results have been analyzed using the distorted-wave Born approximation E1 and E2 virtual photon spectra and the E1 and E2 components of the corresponding (γ,α) cross section were obtained. To assess the accuracy of the virtual photon analysis, the (e,2n) cross section for ^{63}Cu was also measured and the obtained (γ,2n) cross section is compared with direct measurement of this cross section performed with annihilation gamma rays.

21317 (INIS-SU—198, pp 425) **Analysis of correlation of s neutron resonance widths in sup(64,66)Zn.** Knat'ko, V.A.; Shimanovich, E.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21318 (ZfK—491, pp 206-210) **Inelastic scattering of neutrons in the energy range 5 to 8 MeV on yttrium.** Simakov, S.P.; Lovchikova, G.N.; Lunev, V.P.; Sal'nikov, O.A.; Sukhikh, S.Eh. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). Dec 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

By means of the time-of-flight method double differential cross sections of inelastic neutron scattering with incident energies E_0 = 4.86, 6.08, 7.02, and 7.94 MeV have been measured. After a short description of experimental details the results obtained are compared with data cited in the literature. Two mechanisms, namely statistical and direct, come to light by theoretical studies.

21319 (INIS-mf—8307, pp 219) **Reactions induced by heavy projectiles at incident energies above 12 MeV/u.** Hildenbrand, K.D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

Recently we have studied a couple of reactions at energy beyond 12 MeV/u with the upgraded UNILAC at GSI. This report concentrates on the results of the system $^{92}Mo + ^{92}Mo$ obtained at 14.7 MeV/u.

21320 (INIS-mf—8703, pp vp) **Direct radiative capture of thermal neutrons.** Honzatko, J.; Konecny, K.; Becvar, F.; Kosina, Z. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21321 (INIS-mf—8703, pp vp) **^{145}Sm levels excited in the decay of ^{145}Eu.** Adam, J.; Kracik, B.; Kugler, A. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky); Zhelev, Zh.; Penev, I.; Stoyanov, Ch. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21322 (INIS-mf—8703, pp vp) **Decay of ^{149}Eu nuclei oriented in iron and gadolinium matrices.** Kracikova, T.I.; Finger, M.; Lebedev, N.A.; Pavlov, V.N.; Petrik, M. (Joint Inst. for Nuclear Research, Dubna (USSR)); Deryuga, V.A. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21323 (INIS-mf—8703, pp vp) **Spin of the ^{147}Tb and ^{149}Tb nucleus.** Prochazka, I.; Konicek, J.; Finger, M.; Kracikova, T.; Lebedev, N.A.; Tsupko-Sitnikov, V.M. (Joint Inst. for Nuclear Research, Dubna (USSR)); Hamilton, W.D. (Sussex Univ., Brighton (UK)); Muhonen, J. (Jyvaeskylae Univ. (Finland). Dept. of Physics). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21324 (INIS-mf—8703, pp vp) **Decay of ^{147}Gd nuclei oriented in iron and gadolinium matrices.** Kracikova, T.I.; Finger, M.; Tsupko-Sitnikov, V.M. (Joint Inst. for Nuclear Research, Dubna (USSR)); Deryuga, V.A. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)); Hamilton, W.D. (Sussex Univ., Brighton (UK). School of Mathematical and Physical Sciences). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21325 (INIS-mf—8703, pp vp) **Decay of ^{145}Eu nuclei oriented in iron matrix.** Kracikova, T.I.; Finger, M.; Dupak, J.; Konicek, J.; Fominykh, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR)); Deryuga, V.A. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)); Hamilton, W.D. (Sussex Univ., Brighton (UK). School of Mathematical and Physical Sciences). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21326 (INIS-mf—8703, pp vp) **Decay of ^{148}Eu oriented in iron matrix.** Kracikova, T.I.; Finger, M.; Konicek, J.; Lebedev, N.A.; Pavlov, V.N.; Fominykh, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR)); Deryuga, V.A. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21327 (INIS-SU—198, pp 232) **Possible interpretation of the quasirotational bonds in ^{121}Xe.** Belen'kij, V.M.; Volmyanskij, Eh.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21328 (INIS-SU—198, pp 233) **Estimation of nuclear matrix element of electric monopole in sup(197)Au nucleus in model "three-axis rotor plus quasi particle".** Nosilovskaya, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21329 (INIS-SU—198, pp 262) **Refinement of exchange and overlap corrections into probabilities of electron capture for iodine nuclei in atoms and ions.** Boruta, I.I.; Makaryunene, Eh.K.; Makaryunas, K.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21330 (INIS-SU—198, pp 263) **Effect of spin-orbital interaction on the l-forbidden M1-transitions.** Dolgopolov, M.A.; Kapytin, I.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21331 (INIS-SU—198, pp 401) **Electric multipole giant resonances and inverse conversion of muons.** Murav'ev, S.E.; Urin, M.G. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21332 (INIS-SU—198, pp 402) **Taking into account of proton channel coupling in optical-shell description of IAR relaxation widths.** Guba, V.G.; Urin, M.G. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21333 (INIS-SU—198, pp 403) **Extrapolation of giant electric dipole resonance to range of soft compound-compound gamma transitions.** Vtyurin, V.A.; Kadmenskij, S.G.; Popov, Yu.P.; Furman, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21334 (ZfK—491, pp 8-11) **Formation of light charged particles in the system /sup nat/Ag+ ^{40}Ar (285 MeV).** Mikheev, V.L.; Artukh, A.G.; Gridnev, G.F.; Gruszecki, M.; Karcz, W.; Mezentsev, A.N.; Pomorski, L.; Volkov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). Dec 1982. NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

The yield of light charged particles ranging from H to C can be divided into two parts: those having a symmetric relative to 90° c.m. angular distribution and particles with an angular distribution growing exponentially with decreasing emission angle in the forward hemisphere. It is assumed that particles with a symmetric angular distribution are formed partly as the initial dinuclear system ion + target nucleus evolves towards complete fusion in collisions with angular momentum l< approximately l/sub crit/. Particles having a forward peaked angular distribution are produced in massive transfer processes.

21335 (ZfK—491, pp 191-193) **Evaluation of cross sections of fast neutron capture by odd neodymium, samarium, and europium isotopes.** Belanova, T.S.; Blokhin, A.I.; Ignatyuk, A.V.; Kononov, V.N.; Manturov, G.N.; Yurlov, B.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). Dec 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

Study experimental data of radiative capture cross sections and neutron and radiative strength functions cross section curves for ^{143}Nd, ^{145}Nd, ^{147}Sm, ^{149}Sm, ^{151}Sm, and ^{151}Eu, ^{153}Eu, ^{155}Eu in the energy range up to 1 MeV are recommended.

21336 **Compound-nucleus decay via the emission of heavy nuclei.** Sobotka, L.G.; Padgett, M.L.; Wozniak, G.J.; Guarino, G.; Pacheco, A.J.; Moretto, L.G.; Chan, Y.; Stokstad, R.G.; Tserruya, I.; Wald, S. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **51**: No. 24, 2187-2190(12 Dec 1983). Contract AC03-76SF00098.

The production of ^{4}He, Li, ^{7}Be, ^{9}Be, B, C, N, O, and F has been studied in the reaction 90-MeV ^{3}He+ /sup nat/Ag. Although the yields of the heavier elements are orders of magnitude less than for ^{4}He, the energy spectra, charge, and angular distributions indicate that an equilibrium statistical process is responsible for the production of these heavy nuclei in the backward hemisphere.

21337 **(DOE/ER/10710—4) Nuclear structure studies via neutron inteactions. Progress report, July 1, 1983-June 30, 1984.** Carlton, R.F. (Middle Tennessee State Univ., Murfreesboro (USA)). Mar 1984. Contract AS05-80ER10710. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008353.

The research performed during the reporting period consisted of (1) the publication of nuclear structure studies of ^{31}Si, ^{34}S, ^{250}Bk, and ^{250}Cf, (2) completion of the analysis of total neutron cross section measurements on the osmium isotopes and their interpretation in the contexts of astrophysics and the optical model, and (3) total cross section measurements on samples of ^{86}Kr and natural tin. Two missing $1/2^{+}$ states in ^{31}Si predicted by shell model calculations have been observed and spectroscopic factors are in good agreement with predicted values. In addition we observe a fragmentation of p strength in this nuclide in reasonable agreement with predictions. The use of external R-functions deduced from multilevel analyses to calculate the average scattering matrix for ^{30}Si + n, ^{34}S + n, and $^{186\ 187\ 188}$Os + n has demonstrated the requirement of an l-dependence for the real well depth of the optical model potential required to describe these interactions.

21338 (INIS-mf—8703, pp vp) **Study of the decay of ^{171}Lu.** Adam, J.; Hnatowicz, V.; Kracik, B.; Kugler, A.; Zvolska, V.; Zvolsky, J. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21339 (INIS-mf—8703, pp vp) **Multipole mixing ratios of gamma-ray transitions in ^{160}Dy.** Ferencei, J.; Finger, M.; Malinsky, P. (Joint Inst. for Nuclear Research, Dubna (USSR)); Rikovska, J.; Novakova, D. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21340 (INIS-mf—8703, pp vp) **Linear polarization of gamma rays from oriented ^{182}Ta in Fe matrix.** Novakova, D.; Rikovska, J. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia)); Benda, V.; Ferencei, J.; Finger, M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21341 (INIS-mf—8703, pp vp) **^{172}Yb excited states from β decay of oriented ^{172}Lu(Gd).** Novakova, D.; Rikovska, J. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia)); Ferencei, J.; Finger, M.; Jankech, A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21342 (INIS-mf—8703, pp vp) **Properties of ^{153}Gd nucleus (N-89) studied by nuclear orientation technique.** Prochazka, I.; Konicek, J.; Finger, M.; Simeckova, E.; Simecek, P.; Tsupko-Sitnikov, V.M. (Joint Inst. for Nuclear Research, Dubna (USSR)); Muhonen, J. (Jyvaeskylae Univ. (Finland). Dept. of Physics). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21343 (INIS-mf—8703, pp vp) **Decay of oriented ^{172}Lu nuclei.** Davaa, S.; Dupak, J.; Konicek, J.; Kracikova, T.I.; Petrik, M.; Prochazka, I.; Finger, M. (Joint Inst. for Nuclear Research, Dubna (USSR)); Hamilton, W.D.; Girit, D. (Sussex Univ., Brighton (UK). School of Mathematical and Physical Sciences). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21344 (INIS-mf—8703, pp vp) **^{169}Yb properties from the decay of oriented ^{169}Lu.** Davaa, S.; Dupak, J.; Finger, M.; Fominykh, V.I.; Konicek, J.; Kracikova, T.I.; Prochazka, I.; Tsupko-Sitnikov, V.M.; Simecek, P. (Joint Inst. for Nuclear Research, Dubna (USSR)); Hamilton, W.D. (Sussex Univ., Brighton (UK). School of Mathematical and Physical Sciences). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21345 (INIS-mf—8703, pp vp) **Properties of ^{171}Yb from decay of oriented ^{171}Lu(Gd).** Davaa, S.; Kracikova, T.I.; Finger, M.; Dupak, J.; Konicek, J. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21346 (INIS-SU—198, pp 446) **High-energy electron scattering on oriented nonspherical nuclei of the rare-earth region.** Dzhavadov, A.V.; Sadykhov, A.R. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21347 (INIS-mf—8703, pp vp) **Internal conversion of valence electrons - the 10.84 keV transition in ^{206}Bi.** Fujioka, M.; Takashima, M.; Kanbe, M. (Tohoku Univ., Sendai (Japan)); Dragoun, O.; Rysavy, M. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

21348 (INIS-SU—198, pp 264) **Matrix element of penetration of 74.4-keV transition M3-component in ^{191}Os.** Sergeenkov, Yu.V.; Kharitonov, Yu.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21349 (INIS-SU—198, pp 312) **Fast neutron inelastic scattering and characteristics of the excited states in ^{209}Bi.** Simakov, S.P.; Lovchikova, G.N.; Sal'nikoV, O.A.; Titarenko, N.N. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21350 (INIS-SU—198, pp 458) **Some problems of application of R matrix method for description of strong channel coupling in heavy nuclei.** Tertychnyj, G.Ya.; Yadrovskij, E.L. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21351 (INIS-SU—198, pp 488) **Taking into account deformation for description of the deep inelastic heavy ion reactions.** Vydrug-Vlasenko, S.M.; Konstantinov, B.D. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21352 (ZfK—491, pp 38-42) **Light particle emission from heavy ion reactions at modest energies.** Betak, E. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Joint Inst. for Nuclear Research, Dubna (USSR)); Toneev, V.D. (Joint Inst. for Nuclear Research, Dubna (USSR)). Dec 1982. NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

An attempt to estimate the relative role of processes contributing to the light particle (up to alpha) emission from heavy ion reactions is given. The overall agreement of the calculation and the data of $^{22}Ne + {}^{197}Au$ reaction at 178 MeV is reasonable, though minor discrepancies indicate a presence of some another (nonequilibrium) mechanism and/or a need for modification of existing approaches.

21353 (CONF-840395—1) **Microscopic and semi-classical treatments of octupole deformation in the light actinides.** Chasman, R.R. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007359.

From Workshop on semi-classical methods in nuclear physics; Grenoble, France (5 Mar 1984).

Microscopic and semi-classical descriptions of octupole deformation are compared. New semi-classical results, obtained with the use of a Woods-Saxon potential are presented. Comparisons with experiment are made. 21 references.

21354 (NEANDC(J)—86-U) **Evaluation of neutron nuclear data for ^{241}Am and ^{243}Am.** Kikuchi, Yasuyuki. (Nuclear Energy Agency, 75 - Paris (France). Nuclear Data Committee). Aug 1982. 110p. (INDC(JAP)—73-L). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700728.

Neutron nuclear data of ^{241}Am and ^{243}Am were evaluated for JENDL-2. Evaluated quantities are the total, elastic and inelastic scattering, fission, capture, (n,2n), (n,3n) and (n,4n) reaction cross sections, the resolved and unresolved resonance parameters, the angular or energy distribution of the emitted neutrons, and the average number of neutrons, and the average number of neutrons emitted per fission. The fission cross section was evaluated on the basis of newly measured data, and lower values than JENDL-1 were given in the subthreshold energy region. The reliability of the calculation parameters are also much improved, because experimental data became available for the total and capture cross sections of ^{241}Am in the high energy region.

21355 (ZfK—491, pp 145-147) **Energy exchange between internal and collective degrees of freedom at ^{232}Th fission by neutrons.** Kus'minov, B.D.; Malinovskij, V.V.; Mitrofanov, V.F.; Piksajkin, V.M.; Semenova, N.N.; Sergachev, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). Dec 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

Measurements of the mean number of prompt neutrons ν/ sub p/ at ^{232}Th fission by neutrons in the energy range 1.3 to 6.3 MeV are presented. Results are compared with data previously obtained for the kinetic energy of fission fragments E/sub k/. The existence of two energy redistribution mechanisms effecting on the energy dependences ν/sub p/ and E/sub k/ is emphasized.

21356 **Observation of a peak structure in positron spectra from U+Cm collisions.** Schweppe, J.; Gruppe, A.; Bethge, K.; Bokemeyer, H.; Cowan, T.; Folger, H.; Greenberg, J.S.; Grein, H.; Ito, S.; Schule, R. (Gesellschaft fuer Schwerionenforschung, D-1600 Darmstadt, Federal Republic of Germany; A. W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06511; University of Frankfurt, D-6000 Frankfurt am Main, Federal Republic of Germany; University of Heidelberg). *Physical Review Letters;* **51**: No. 25, 2261-2264(19 Dec 1983). Contract AC02-76ER03074.

A narrow peak structure has been observed in positron spectra from U+Cm collisions at bombarding energies near the Coulomb barrier whose origin cannot be associated with established dynamic mechanisms of positron production involving Rutherford trajectories only. The peak's energy is centered at 316 +- 10 keV. Its width of $\sim$80 keV, dominated by Doppler broadening, implies that the emitting system exists for longer than $\sim 10^{-20}$ sec.

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REFER ALSO TO CITATION(S) 21232, 21236, 21237, 21351, 21353

21357 (CBPF-NF—034/82) **Systematics of spallation yields with a four-parameter formula.** Foshina, M.; Martins, J.B.; Tavares, O.A.P.; Di Napoli, V. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701086.

A semi-empirical four-parameter formula is proposed in order to systematize intermediate- and high-energy proton-induced spallation yields of target nuclei covering the 50-100 mass number interval. The measured yields are reproduced by the formula with a degree of accuracy which is comparable with or better than those obtained in previous proton-spallation systematics. The formula predicts reliable values for the most probable mass number of isotopic distributions. For a number of irradiation conditions which may be encountered in practical and physical applications, estimates of proton spallation yields can be obtained by the proposed four-parameter formula with no need of high-speed machines.

21358 (DOE/ER/05126—207) **New approach to polarized proton scattering based on Dirac dynamics.** Wallace, S.J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1983. Contract AS05-76ER05126. 47p. (ORO—5126-207; CONF-8311144—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008018.

From Los Alamos meson physics facility users group meeting; Los Alamos, NM, USA (7 Nov 1983).

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The Dirac impulse approximation has to date provided dramatic improvement in our ability to predict, with no free parameters, spin observables in proton-nucleus elastic scattering at intermediate energies. The key ingredients of this approach are Dirac propagation and the nucleon-nucleon invariant amplitudes. So far, local approximations to the NN amplitudes have been used. The standard NN representation in terms of Dirac scalar, vector, and so on, parts which is free of kinematical singularities seems to naturally predict the correct coupling to negative energy states for energies above 300 MeV. At low energy, this coupling is subject to an ambiguity between pseudoscalar and pseudovector πN coupling mechanisms and it is evident that the pseudoscalar coupling treated in a local approximation causes too much scalar-vector difference and thus too large pair contributions. Once this problem is remedied, the Dirac optical potential is expected to be calculable from a nucleon-nucleon quasi-potential over the range 0 to 1000 MeV. For the energy region above about 300 MeV, the large scalar and vector potentials of Dirac phenomenology are seen to be accurately predicted by the impulse approximation. Work by Shakin and collaborators provides complementary results at low energy based on a nuclear matter g-matrix. A basic conclusion is that relativistic spin effects cannot be neglected in nuclear physics. 36 references. (WHK)

21359 **(IFT-P—04/82) Collective aspects of a two alpha clusters system.** Galetti, D.; Mizrahi, S.S. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701079.

A collective Hamiltonian, its energy spectrum and the corresponding wave functions describing a two alpha particles cluster, which simulates the ^{8}Be nucleus, are numerically calculated starting from microscopic considerations within an approach of the Generator Coordinate Method. The internucleon force considered here is the one proposed by Brink and Booker plus the Coulomb repulsion. The collective potential, inertia function and low lying energy levels of the system are presented and analysed.

21360 **(IFUSP-P—321) Measure of absorption in multistep compound processes.** Carlson, B.V.; Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Feb 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701075.

The Moldauer-Simonius theorem, that relates the modulus of the determinant of the average, optical S-matrix, to the average width and spacing of the compound nucleus resonances, is generalized to the multiclass resonances situation encountered in pre-equilibrium reactions. Corrections to the generalized M/S theorem are seen to be connected primarily to the width distribution of the widest doorway class.

21361 **(IFUSP-P—332) Peierls-Brayshaw resonances.** Isidro Filho, M.P.; Coutinho, F.A.B. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701081.

The connection between bound states and/or resonances of a three-particle system and bound states and/or resonances of a two-particle subsystem is investigated for three identical bosons in one-dimension. It is found that, in general, if the two-particle subsystem has a bound state of energy ν sub(o) then the three-particle system will have a bound state at the energy 4ν sub(o).

21362 **(IFUSP-P—336) Instanton contributions to the valence band of the double Sine-Gordon potential.** Ricotta, R.M.; Escobar, C.O. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1982. 12p. (IFT-P—08/82). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701082.

The energy dispersion relation for the valence band of the double sine-Gordon potential is calculated, approximating the tunneling amplitude by a sum of contributions of multi-instantons and anti-instatons trajectories. The interesting feature of this potential is that they have to deal with two types of instantons, as there are two different potential barriers within one period of the potential. The results with the standard WKB approximation are compared.

21363 **(IFUSP-P—350) Generator coordenates and giants resonances.** Passos, E.J.V. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1982. 14p. (In Portuguese). (CONF-820460—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701087.

From 1. Brazilian symposium on photonuclear physics; Sao Paulo, Brazil (5 Apr 1982).

As an example of the use of Generator Coordinate Method in the description of collective states of nuclei, is considered its application in the multipolar giant resonance description.

21364 (INIS-SU—198, pp 227) **Equilibrium deformations of odd nuclei of rare earth region.** Alikov, B.A.; Zuber, K.; Pashkevich, V.V.; Tsoj, E.G. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21365 (INIS-SU—198, pp 234) **Vector dominance and coulomb potential of nucleus.** Birbrair, B.L.; Savushkin, L.N.; Fomenko, V.N. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21366 (INIS-SU—198, pp 135) **Energy dependence of real part of optical nuclear potential.** Birbrair, B.L.; Sadovnikova, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21367 (INIS-SU—198, pp 253) **Perturbation of tha angular $\gamma\gamma$-correlations by the surface acoustic waves.** Batkin, I.S.; Berkman, M.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21368 (INIS-SU—198, pp 256) **Modulation of elastic scattering on nuclei by resonance external field.** Batkin, I.S.; Berkman, M.I.; Sajko, D.S. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21369 (INIS-SU—198, pp 259) **g-Factor of nuclear levels.** Avotina, M.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21370 (INIS-SU—198, pp 970) **Weak corrections to elastic scattering of photons on nuclei at low energies.** Zhel'mi, L.; Amiralov, A.S. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21371 (INIS-SU—198, pp 272) **Structure effect on probabilities of βsup(+-) transitions.** Krygin, G.B.; Mitroshin, V.E. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21372 (INIS-SU—198, pp 274) **Effect of nuclear toroidal moments on atomic electron shell.** Polegen'skij, V.V.; Shulyakovskij, G.S. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21373 (INIS-SU—198, pp 320) **Even-odd effects in elastic scattering of α particles with the energy near to 27.2 MeV on nuclei.** Gonchar, V.G.; Tokarevskij, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21374 (INIS-SU—198, pp 353) **Allowance for the effect of monochromatic gamma radiation parameters on the characteristics of photonuclear reaction cross sections.** Varlamov, V.V.; Kapitonov, I.M.; Ufimtsev, M.V.; Chernyaev, A.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21375 (INIS-SU—198, pp 354) **Effects of secondary composite particle production in the (γ,γ'b)-type reactions.** Zhivopistsev, F.A.; Slivnoj, A.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21376 (INIS-SU—198, pp 382) **Statistical regularization method for calculation of the cross sections photoneutron reactions.** Belyaev, S.N.; Kozin, A.B.; Nechkin, A.A.; Vasil'ev, O.V.; Semenov, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21377 (INIS-SU—198, pp 405) **Fluctuations of tensor polarization in the nuclear reactions.** Kun, S.Yu. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21378 (INIS-SU—198, pp 405) **Ericson fluctuations and Hauser-Feshbach model in the unitary theory.** Kun, S.Yu. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21379 (INIS-SU—198, pp 406) **Polarization of particles evaporating from nucleus with large angular momentum.** Zavarzin, V.F.; Kun, S.Yu. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21380 (INIS-SU—198, pp 408) **Algebraic realization of resonating-group method for multichannel problem in eight nucleon system.** Badalov, S.A.; Filippov, G.F. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21381 (INIS-SU—198, pp 410) **Generalization of solving the bound-state problem for the case of resonance states.** Orlov, Yu.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21382 (INIS-SU—198, pp 411) **Investigation of the three-particle resonances by means of Faddeev equation analytical prolongation.** Orlov, Yu.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21383 (INIS-SU—198, pp 414) **Dynamics of four-particle systems with short-range forces.** Levashev, V.P.; Navrotskij, M.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21384 (INIS-SU—198, pp 415) **Effect of system finiteness on imaginary part of optical potential.** Bunakov, V.E.; Matveev, G.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21385 (INIS-SU—198, pp 422) **Unitary theory of fluctuations in nuclear reactions.** Girko, V.L.; Ol'khovskij, V.S.; Chinarov, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21386 (INIS-SU—198, pp 426) **Nuclear structure and bremsstrahlung spectra of fast particles.** Amus'ya, M.Ya.; Potapova, T.M.; Gul'karov, I.S. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21387 (INIS-SU—198, pp 429) **Estimation of fluctuation effects of resonance parameters in an analysis of an experiment on neutron transmission.** Komarov, A.V.; Luk'yanov, A.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21388 (INIS-SU—198, pp 440) **Inclusive spectra of reactions with composite particle yield and direct mechanisms.** Kadmenskij, V.G.; Kadmenskij, S.G.; Ratis, Yu.L.; Furman, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

21389 (INIS-SU—198, pp 444) **Effective nucleon-nucleon interactions and energy dependence of a nucleon optical potential.** Knyaz'kov, O.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21390 (INIS-SU—198, pp 445) **Optical potential of pion in atomic nucleus in the multiple scattering theory and properties of the π-N amplitude in the "off-the-mass-shell" regions.** Chekunaev, N.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21391 (INIS-SU—198, pp 457) **Nonlinear equations and application in nuclear physics.** Gridnev, K.A.; Semenov, V.M.; Khefter, Eh. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21392 (INIS-SU—198, pp 459) **Using of the R matrix method for description of continuum states and bound states of nucleons in the Woods-Saxon potential.** Tertychnyj, G.Ya.; Yadrovskij, E.L. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21393 (INIS-SU—198, pp 460) **Time change of a nucleus field acting on a classical particle.** Sorokin, A.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21394 (INIS-SU—198, pp 464) **Quasi-elastic knock-out (p,psup(')d) reaction at large transfered momenta and the Glauber-Sitenko method.** Kadmenskij, S.G.; Ratis, Yu.L. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21395 (INIS-SU—198, pp 465) **Coherent diffraction dissociation on nuclei.** Arushanov, G.G.; Ismatov, E.I.; Arushanov, V.G.; Sattarov, M.G. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21396 (INIS-SU—198, pp 474) **Theory of direct nuclear reactions in an approximation of classical trajectories.** Zagrebaev, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21397 (INIS-SU—198, pp 475) **Quasi-classical description of deuteron stripping and breakup reaction.** Zagrebaev, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21398 (INIS-SU—198, pp 481) **Angular correlations of particles evaporating from fast rotating nucleus.** Aleshin, V.P.; Ofengenden, S.R. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21399 (INIS-SU—198, pp 484) **Kinetic description of heavy ion reactions in the adiabatic approximation.** Isaev, P.N. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21400 (INIS-SU—198, pp 487) **Reflectionless potentials and anomalous backscattering.** Gridnev, K.A.; Ivanov, A.G.; Saad, S.; Semenov, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

21401 (INIS-SU—198, pp 490) **Population probability of substates with M=+-1 of target nucleus 2sup(+) states in proton resonance inelastic scattering.** Kangrapol', Yu.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 21183

21402 **(AERE-M—3316) On-line calculation of ion range and damage distributions. Part 1: low ion energies, using Winterbon's tables.** Bains, H.S. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). May 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700744.

This document is intended as a guide to the structure of the program and the panels which are available for running it. In addition it describes the input and output it requires and generates as well as the allocation of files and data sets needed to run the program.

21403 **(CONF-831254—3) Data needs for the track structure of alpha particles and electrons in water.** Pagnamenta, A. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009154.

From Agricultural electronics - 1983 and beyond conference; Chicago, IL, USA (11 Dec 1983).

We have made calculations of the ionization spectra for alpha particle and electron tracks in water. We have also computed the number of ions created per micrometre of track length, the energy distribution of the secondaries, and the energy expended per ion pair created. Our aim is less toward theoretical derivations than to obtain a numerically accurate description of the track structure at all energies in a form suitable for biomedical applications. 13 references.

21404 **(INR—615/9-A/R) Spectrum of the Boltzmann operator with an isotropic thermalization kernel.** Bednarz, R. (Institute of Nuclear Physics, Krakow (Poland)). Mar 1965. 24p. NTIS (US Sales Only), PC A02. Order Number DE84901003.

Paper copy only, copy does not permit microfiche production .

The paper contains the proof of the six theorems concerning spectrum of the Boltzmann operator with isotropic thermalization kernel in bounded and convex geometry. The applicability of the spectral theorems to gases, liquids and solids has been discussed.

21405 **(INS-NUMA—29) Proceedings of the study meeting on heavy and light ion irradiations and radiation measurement. NUMATRON project for interdisciplinary research.** Nakamura, Takashi; Hirao, Yasuo (eds.). (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1981. 156p. (In Japanese). (CONF-8107122—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780112.

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

The papers presented were entered into the data base separately. (WHK)

21406 **(NEANDC(E)—242-U(Vol.3)) Annual progress report on nuclear data, 1982.** (Nuclear Energy Agency, 75 - Paris (France). Nuclear Data Committee). Mar 1983. 73p. (INDC(EUR)—017-G). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700726.

The first part of this report deals with neutron data: cross sections of actinides, structural materials, fission products, and standard neutron data. In the second part, decay studies, data complications and source preparation techniques and measurements are given.

21407 **(RL—83-072) Neutron scattering from forced and relaxing systems.** Gunn, J.M.F. (Rutherford Appleton Lab., Chilton (UK)). 13 Jul 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701076.

Scattering from a forced harmonic oscillator is considered. A number of interesting features occur in the inelastic spectrum: enhancement of high energy transfers and oscillations in the scattering intensity in any particular channel as resonance is approached, both of which may be practically useful. The behaviour on resonance is derived and is qualitatively different. We discuss the relevance to general systems, and show that neutron scattering directly measures the analogue of the energy levels of the forced system, its quasi energy spectrum. Scattering from an oscillator out of equilibrium with its environment is also considered. We find additional structure in the inelastic spectrum from which the relaxation time can be deduced.

6550 Medical Physics

REFER ALSO TO CITATION(S) 19818

21408 **(AECL—7617) Tables of beta-ray dose distributions in water, air and other media.** Cross, W.G.; Ing, H.; Freedman, N.O.; Mainville, J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1982. 94p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84701077.

Tables and graphs are given of beta-ray dose distributions near isotropic point and plane beta sources in water and air, for 95 nuclides of importance in medicine and radiation protection. These are calculated from Spencer's dose-distribution tables for monoenergetic electrons and from recent nuclear decay data. Information is given for determining dose distributions in other low-Z media.

21409 **(IAEA-R—3088-F) Measurement of depth dose factors for various 60-Co and X-ray beams using ion chambers and thermoluminescent dosemeters. Final report for the period 1 May 1982-30 April 1983.** Milu, C. (International Atomic Energy Agency, Vienna (Austria)). Jun 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700768.

As the depth dose factors may vary with the type of ^{60}Co unit (or X-ray generator) several determinations in this direction were done. The depth doses (mGy/s) for ^{60}Co beam (SSD=80cm) for the depths 5,10,15 and 20 cm were 11.92, 8.25, 5.75 and resp. 4.10 for field size 10x10 cm and 12.70, 9.42, 6.63 and resp. 4.93 for field size 20x20 cm. In X-ray beam, the depth doses (mGy/s) for FSD=50 cm, open-end and field size 10 cm diam. were: 1.78, 0.66, 0.23 and 0.09 for 100 kV (0.143 mm HVL, in air) and depths 5, 10, 15 and resp. 20 cm; 2.61, 1.12, 0.46 and 0.19 for 135 kV and 4.13, 1.88, 0.88 and 0.40 for 180 kV. The quality of the radiation at different depths in the water phantom was determined using a tandem TLD within Cu sleeve and TLD without Cu sleeve. The values obtained ranged from 0.018 mm Cu for 100 kV to 0.170 for 180 kV at depth 5 cm. All determinations were done using an IAEA perspex water tank and Harshaw extruded LiF as detectors. An intercomparison using LiF powder capsules prepared and sent by the IAEA Dosimetry Laboratory was performed too, in order to check the consistency of thermoluminescent dosimetry systems.

21410 (INS-NUMA—29, pp 50-55) **Measurement of dose rate of secondary neutrons and gamma-ray produced by heavy ion beam.** Ishihara, Toyoyuki (Tsukuba Univ., Sakura, Ibaraki (Japan). Tandem Accelerator Center). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

The dose rates of secondary neutrons and gamma-ray produced by heavy ion bombardment were measured for various targets. The dose rate is required to obtain the basic data of radiation dosimetry. Neutron dose was measured by a neutron dose rate meter (2202 D, Studsvik, Sweden), and gamma-ray was measured by an ionization chamber survey meter. The observed yields of neutrons and gamma-ray depended on the kinds of incident particles and their energies. The yields for the various combinations of targets and particles were investigated, and the dose rate of neutrons was large in the case of Be targets. When the incident particles were protons or deuterons, the yield was remarkably large. The contribution of neutrons to the biological absorbed dose rate was large, but that of gamma-ray was small.

21411 (INS-NUMA—29, pp 98-105) **Proton beam dosimetry and intercomparison with ionization chambers.** Hiraoka, Takeshi; Kawashima, Katsuhiro; Hoshino, Kazuo; Kouchi, Kiyomitsu; Kanai, Tatsuaki (National Inst. of Radiological Sciences, Chiba (Japan)). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

For the purpose of proton therapy, proton beam dosimetry has been studied. The measurement is usually made with ionization chambers. The factors which exert effects on the estimation of dose are the ion recombination loss, the stopping power, and the W value. In the case of 60 MeV proton beam, the ion recombination loss was studied with a parallel plate ionization chamber. The experimentally obtained relation of applied voltage and ion collection efficiency was in good agreement with the results according to the theory of general recombination loss given by Boag. The stopping power was considered to be a constant at any depth. The precise data of W values at high energy are scarce, and the accumulation of the data is required. Mutual comparison of proton absorption dose has been made by taking the data at various institutes in Japan and US. Agreement between the data was very good.

21412 (INS-NUMA—29, pp 106-115) **Microdosimetry of a 160 MeV proton beam.** Ito, Akira (Tokyo Univ. (Japan). Inst.for Medical Science). Jul 1981. NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

Experimental microdosimetry of the 160 MeV proton beam from the Harvard synchrocyclotron is reported. The proton beam, which is routinely used for radiation therapy, is modulated with a ridge filter to form a flat depth dose distribution. Measurements were performed at 4 depths in the lucite absorber, using a conventional tissue equivalent spherical proportional counter with a logarithmic amplifier which made the recording and analysis quite simple. All the energy deposition (y) spectra were analysed in the conventional manner and y-var sub(F) and y-bar sub (D) were calculated. The fractional dose of higher LET component ($y > 10$ keV/μm), increased from 4 to 14% toward the distal end of the extended peak region. Correspondingly, the y bar sub(F), y bar sub(D) were increasing at the deeper depths. Based on the dual radiation action theory, the RBE of this proton beam at the entrance region would be unity and the maximum possible RBE at the distal end of the peak would be about two. Finally, the radiation quality of this proton beam was compared with other type of radiations.

21413 **(INS-TS—21) Refinement of 52-MeV proton irradiation course for biological and medical use and its absorbed dose evaluation.** Uwamino, Yoshitomo; Nakamura, Takashi; Ohkubo, Tooru; Ito, Akira; Ohtsu, Shinobu. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1982. 17p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700769.

A 52-MeV proton irradiation course for biological and medical use was consolidated at the FM cyclotron of the Institute for Nuclear Study, University of Tokyo. The course was equipped with a 0.2-mm-thick stainless steel beam scatterer, beam slits, a beam current monitoring ionization chamber, a rotating 2-dimensional beam profile monitor, a range modulator and a Faraday cup. Absorbed dose was measured with a parallel-plate tissue-equivalent chamber and the Faraday cup, and both measurements agreed well each other within a 7.5% error. The beam flatness was greatly improved by the 0.2-mm-thick stainless steel beam scatterer installed at about 5 m upper stream from the irradiation point, and the reproducibility of the dose distribution was also improved. However, since there is no beam analyzing apparatus between the cyclotron and the irradiation point, the beam profile stability was not good enough and the beam shaping by the slits was not sharp. The effect of multiple scattering at the range modulator placed at 26 cm upper stream from the irradiation point was noticeable, but it was well evaluated by some simple theoretical formulae.

21414 (NIRS-M—35, pp 243-255) **Risk factor of thyroid. Some aspects of dose evaluation.** Kusama, Tomoko (Tokyo Univ. (Japan). Faculty of Medicine). 1979. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. (CONF-7911194—).

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

For the purposes of radiation protection, the noteworthy risk of thyroid is carcinogenesis. The risk factor which ICRP presented in the publication-26 is 5×10^{-6} rem^{-1}. This numerical value is based upon the estimated likelihood of inducing fatal thyroid cancer. On the other hand, the risk factor presented by the BEIR report is 4×10^{-6} yr^{-1}. This value was decided after consideration of the risks of both fatal and non-fatal cancer of thyroid. The following features distinguished thyroid cancer from malignancy of other tissue from medical point of view. 1) A large difference between incidence and mortality in case of thyroid cancer is recognized, because the thyroid cancer could be successfully treated by surgical or radiological treatment. 2) The high prevalence of clinically silent tumor in thyroid gland has been reported. The incidence of thyroid cancer, therefore, is very dependent on methods of medical inspection. The prevalence of radiation induced thyroid cancer is modified by various factors such as age, sex, latency, dose and dose rate. The latent period has very important factors such as age, sex, latency, dose and dose rate. The latent period is a very important factor in the estimation of accumulated total risk of thyroid malignancy. What is included in the risk caused by thyroid irradiation must be investigated. The risk of non-fatal cancer should be considered in the same way as that of fatal cancer. The dose-equivalent limit of thyroid in non-uniform irradiation caused by radioactive iodine is decided by the limit for non-stochastic effects.

Therefore the further consideration of non-stochastic effects of thyroid is necessary.

21415 **(UCRL—88391) New technique to improve the accuracy of albedo neutron dosimeter evaluations.** Hankins, D.E. (Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-7405-ENG-48. 6p. (CONF-840512—6). NTIS, PC A02/MF A01. Order Number DE84002458.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

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The calibration factor for albedo neutron dosimeters varies greatly depending upon the energy of the neutrons in the exposure. Calibration results obtained over an eight-year period at each Lawrence Livermore National Laboratory facility where neutron exposure may occur were reviewed. A stronger relationship than expected was found between the ratio of the readings of the 9-in. to 3-in. spheres and the percent thermal. Readings from personnel and albedo badges were reviewed. The readings were consistent with the use of a calibration factor for the albedo dosimeter which varies with changes in the ratio of the personnel and albedo dosimeter TLD readings. 2 references, 6 figures. (ACR)

21416 **Determination of microdosimetric parameters in time-varying radiation fields: the variance-covariance method.** Kellerer, A.M. (Inst. fuer Medizinische Strahlenkunde der Univ. Wuerzburg, West Germany); Rossi, H.H. *Radiation Research;* **97**: No. 2, 237-245(Feb 1984). Contract AC02-78EV04733.

Microdosimetric measurements in their usual form are difficult in fields of high intensity where events, i.e., passages of charged particles, cannot be individually resolved. The variance method can then be utilized to obtain the dose averages of the microdosimetric distributions from repeated measurements over finite time intervals. An essential condition for the method is that the dose per measurement interval is constant, but this condition cannot be fulfilled in accelerator-produced fields that consist of variable radiation pulses. A modified method is therefore proposed that does not require equal doses per measurement interval. It utilizes two detectors that operate in phase, and it derives the microdosimetric parameters from the difference between the variance of the signal from one detector and the covariance of the concomitant signals from the two detectors.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 20504, 20510

21417 **(CBPF-NF—017/82) Renormalisation-group specific heat of the square lattice Potts ferromagnet.** Martin, H.O.; Tsallis, C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701035.

The free and internal energies and specific heat of the q-state Potts ferromagnet are discussed. A real space renormalisation group approach is presented which recovers a considerable amount of exact particular results for all dimensionalities (hypercubic lattices). The square lattice case is calculated in detail by using self-dual clusters (which provide the exact critical point for all q). Comparison with Onsager results (q=2) is satisfactory; the general tendencies for q different 2 (1<=q<=4) are exhibited, and the bond percolation limit (q→1) is worked out with some detail.

21418 **(CBPF-NF—032/83) New effective-field theory for the Potts model.** Honmura, R.; Sarmento, E.F.; Tsallis, C.; Fittipaldi, I.P. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701036.

A new type of effective field theory that has recently been used with success for many applications concerning the Ising model is through the generalization of Callen identities, herein extended to the q-state Potts model. Although mathematically simple, it yields results quite superior to those currently obtained within the Molecular Field Approximation. In order to test its reliability we check the following properties: (a) the critical temperature T sub(c) associated with a linear chain vanishes for all q; (b) the value of T sub(c) associated with a z - coordinated lattice (z > 2) exhibits a q-dependence qualitatively (and to a certain extent quantitatively) satisfactory; (c) the z → infinite limit reproduces the exact value for T sub(c); (d) for fixed z, all values of q > 2 provide first order phase transitions, which is exact for d > 4. Furthermore the procedures for obtaining, as functions of temperature and for any values of q and z, the order parameter, internal energy and specific heat are outlined, and some typical illustrations are presented.

21419 **(CBPF-NF—041/82) Finite groups lattices and automorphisms.** Zanette, S.I.; Caride, A.O. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700996.

It is proved that the elements of the group of automorphisms of a finite group allow the reduction of the number of chains for which it is necessary to calculate the irreducible representations. Moreover, if the outer automorphisms of a finite group have the property of interchange classes of conjugate elements, it is shown that it is also possible to reduce the number of irreducible representations to be calculated. The method developed is applied explicitly to the maximal subgroups lattice of the dihedral group D sub(2α) which is isomorphic to C sub(2α,v) and D sub(2α (sup(-1)) d). Then it is discussed the application of the method to crystallographic point groups, as well as the use of automorphisms to establishing relations between the Clebsch-Gordan coefficients of a finite group.

21420 **(CBPF-NF—042/82) Break-collapse method for resistor networks-renormalization group applications.** Tsallis, C.; Coniglio, A.; Redner, S. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700997.

The break-collapse method recently introduced for the q-state Potts model is adapted for resistor networks. This method greatly simplifies the calculation of the conductance of an arbitrary two-terminal d-dimensional array of conductances, obviating the use of either Kirchhoff's laws or the star-triangle or similiar transformations. Related properties are discussed as well. An illustrative real-space renormalization-group treatment of the random resistor problem on the square lattice is presented; satisfactory results are obtained.

21421 **(DOE/ER/10459—46) Studies on sub-micron devices with emphasis on MOS systems. Final report, July 1, 1983-June 30, 1984.** O'Connell, R.F. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 1984. Contract AS05-79ER10459. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010029.

As part of our theoretical studies of Faraday rotation and ellipticity in MOS (metal-oxide-semiconductor) systems, we completed our investigations of the effects due to the metal gate and due to multiple reflections within both the oxide layer and the semiconductor. We also carried out some preliminary work on the influence of memory effects on our basic model. We then made a comparison with the first reported observational results of Faraday rotation in a MOS system. While a measure of agreement between theory and observational was obtained, it is clear that there are serious discripancies existing, which will require further analysis. For the past few years the author has been working on a comprehensive review entitled Distribution Functions in Physics: Fundamentals, in collaboration with Professor E. P. Wigner (whose seminal paper in 1932 introduced the first distribution function), Professor M. O. Scully and Dr. M. Hillery. This review, which was a prodigious task, has now been completed and accepted for publication in Physics Reports. In addition, E. P. Wigner and the author are continuing their efforts to incorporate Bose and Fermi statistics into distribution functions, with applications in mind to the two-dimensional systems discussed above.

21422 **(IFUSP-P—320) Phase coexistence in a lyotropic 'nematic' liquid crystal of potassium laurate /KCl/ water.** Figueiredo Neto, A.M.; Amaral, L.Q. do. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Feb 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701038.

Type I lyomesophase of potassium laurate was studied by X-ray diffraction techniques with temperature variation. The previously proposed structure of this mesophase is composed by aggregates of cylindrical micelles packed in an hexagonal array. A temperature region of phase coexistence between type I and hexagonal H sub(α) phases (50-60°C) was determined. The lattice parameters of the two phases are 49.9 and 44 A respectively. The range of coexistence is located inside the observed by NMR studies (20-60°C). A binary system of potassium laurate/water (H sub(α) phase) studied by X-ray diffraction shows orientational and segregational effects. The container walls effects are important in the appearence of the coexistent H sub(α) phase. Modification of the solvation shell bounded to the micelles is probably responsible for the formation of the long range ordered structures and for the differences in lattice parameters.

21423 **(IFUSP-P—330) Intermicellar interactions in type I lyotropic 'nematic' liquid crystals.** Figueiredo Neto, A.M.; Amaral, L.Q. do. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701039.

The application of classical DLVO theory to a type I lyomesophase indicates that the cylindrical amphiphilic micelles tend to flocculate; the screening process is so efficient that the van der Waals attractive force is higher than the coulombian repulsive one (this later caused by the ionization of the micellar surface polar groups). The flocculation process forms a hexagonal network with lattice parameter (determined by X-ray diffraction techniques) of 49.9 A. This result can be explained assuming that the micelles have a bound solvation shell around them about 8 A thick. The balance between van der Waals attraction and excluded volume interaction is responsible for the aggregation process. The calculated energy of two interacting micelles 50 A appart is about KT, indicating that at the bulk of the lyomesophase only small aggregates can exist. However, external agents like electric and magnetic fields or wall containers, which restrict degrees of freedom of the micelles, favours flocculation. The container wall effect is described as a micellar anchoring process.

21424 **(PUC-TN—04/82) Monte Carlo study of the phase diagram for the two-dimensional Z(4) model.** Carneiro, G.M.; Pol, M.E.; Zagury, N. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). May 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701010.

The phase diagram of the two-dimensional Z(4) model on a square lattice is determined using a Monte Carlo method. The results of this simulation confirm the general features of the phase diagram predicted theoretically for the ferromagnetic case, and show the existence of a new phase with perpendicular order.

21425 **(UIUCDCS-R—83-1154) Quasi-Newton and multigrid methods for semiconductor device simulation.** Slamet, S. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Dec 1983. Contract AC02-76ER02383. 81p. (UILU-ENG—83-1734; COO—2383-0102). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008487.

Portions are illegible in microfiche products; Thesis.

A finite difference approximation to the semiconductor device equations using the Bernoulli function approximation to the exponential function is described, and the robustness of this approximation is demonstrated. Sheikh's convergence analysis of Gummel's method and quasi-Newton methods is extended to a non-uniform mesh and the Bernoulli function discretization. It is proved that Gummel's method and the quasi-Newton methods for the scaled carrier densities and carrier densities converge locally for sufficiently smooth problems.

21426 **Snoidal sine-Gordon kinks and renormalization effects.** Hammer, C.L.; Ely Shrauner, J. (Ames Laboratory, U.S. Department of Energy, Ames, Iowa 50011; and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **29**: No. 1, 232-238(1 Jan 1984). Contract W-7405-ENG-82.

The effects of a condensate of snoidal-wave solutions of a sine-Gordon theory in one space and one dimension at finite temperature are studied. The resulting statistical mechanics and renormalization of snoidal kinks are uniquely characteristic of our treatment.

6561 Superconductivity

REFER ALSO TO CITATION(S) 20443, 20479, 20489, 20536

21427 **(AD-A—134140/3) Extensions of the theory of the electron-phonon interaction in metals: a collection. Final report.** Pickett, W.E. (Naval Research Lab., Washington, DC (USA)). 3 Nov 1983. 71p. (NRL-MR—5214). NTIS, PC A04/MF A01.

This report presents several contributions to the formulation, calculation and understanding of the effects of electron-phonon interaction in metals with variation in the electronic density of states on the scale of a typical phonon energy. The A15 compound Nb3Sn is studied in detail with this theory.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 21426

21428 **(CBPF-NF—009/82) Gauge and non-gauge curvature tensor copies.** Srivastava, P.P. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Mar 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700990.

The space-time connections giving rise to the same curvature tensor are constructed and the corresponding geometries compared. The notion of gauge and non-gauge copies in the context of tetrad formulation is elucidated and illustrated by an explicit calculation. Some comments are made on the copies in Einstein-Cartan and Weyl-Cartan geometries.

21429 **(CBPF-NF—027/82) Non-holomy and the diffusion of particles. Part 2.** Soares, P.C.; Gomes, Luiz Carlos. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701020.

The equilibrium solution of the Fokker-Planck equation for both Liouvillian and non-Liouvillian system is obtained. The procedure to solve the diffusion equation for non-holonomic systems is exhibited. A suggestion to where such systems may be found in nature, at the microscopic level is presented.

21430 **(CBPF-NF—038/82) Experiments to detect possible failures on relativity theory.** Rodrigues Junior, W.A.; Tiomno, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701025.

Conditions under which is expected the failure of Einstein's Relativity are analysed. A complete analysis of a recently proposed experiment by Kolen-Torr is also given showing that it must give a negative result.

21431 **(CBPF-NF—044/82) Expressions for the solutions of the Riesz-Mercier equation.** Silveira, A. da; Amaral, A.F.F. do. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700999.

Expressions for the aggregates and currents of the Riesz-Mercier equation are considered.

21432 (IFT-P—03/82) Spinor monopole harmonics and the Pauli spin equation. Pereira, J.G.; Ferreira, P.L. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701031.

In the framework of Wu and Yang theory of U(1) magnetic monopoles, two problems are revisited: (i) the binding of spin-0 monopole to a spin-1/2 particle possessing an arbitrary magnetic dipole moment, and (ii) the energy levels and properties of the electron-dyon system. In both problems, the spin-1/2 particle is assumed to obey the Pauli spin equation. Spin-orbit and other higher order terms are treated as a perturbation, in connection with the second mentioned problem. Wu and Yang's spinor monopole harmonics allow an elegant and simplified treatment of those problems. The results obtained are in good agreement with those obtained in older papers.

21433 (IFT-P—14/82) Radius of convergence of the Rayleigh-Schroedinger solution for the quantum quartic oscillator in a box. Aguilera-Navarro, V.C.; Gomes, J.F.; Zimerman, A.H.; Ley Koo, E. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701021.

The energy eigenvalues of the quartic potential in a box are obtained exactly and perturbatively using the basis of eigenstates of the free particle in a box. The exact eigenvalues are obtained from the diagonalization of the Hamiltonian in that basis. The perturbative solution is constructed from the Rayleigh-Schroedinger expansion using the quartic potential as the perturbation. The perturbative series is shown to be convergent for small boxes, and an upper bound for the radius of convergence is estimated. Pade-approximant solution, valid for boxes of any size, are also constructed. The numerical comparison of the perturbative and Pade-approximant solutions with the exact ones confirms the validity of the former, especially the convergence and the radius of convergence of the perturbative series.

21434 (IFT-P—17/82) Radius of convergence of Rayleigh-Schroedinger perturbative solutions for quantum oscillator in circular and spherical boxes. Aguilera-Navarro, V.C.; Gomes, J.F.; Zimerman, A.H.; Ley Koo, E. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701022.

The energy eigenvalues of harmonic oscillator in circular and spherical boxes are obtained through the Rayleigh-Schroedinger perturbative expansion, taking the free particle in a box as the non-perturbed system. The perturbative series is shown to be convergent for small boxes, and an upper bound for the radius of convergence is established. Pade-approximant solutions are also constructed for boxes of any size. Numerical comparison with the exact eigenvalues - which are obtained by constructing and diagonalising the Hamiltonian in the basis of the eigenfunctions of the free particle in a box - corroborates the accuracy and range of validity of the approximate solutions, particularly the convergence and the radius of convergence of the perturbative series.

21435 (IFT-P—18/82) Theorem for a class of motions in a spherical geometry. Ferreira, P.L. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701023.

Considering the motion, at classical level, of a point particle constrained to move under the influence of a conservative center of force, on a N-sphere S sup((N)), embedded in an Euclidean (N+1)-dimensional space, it is shown that, if the motion on S sup((N)) is obtained from the motion on a tangent N-plane π sup((N)) by means of a central projection, then the equations of motion on S sup((N)) can be obtained from those on the Euclidean π sup((N)) by a local reparametrization of time. Some consequences of the theorem are also discussed.

21436 (IFUSP-P—329) Origin of anomalies in the quantum nonlocal charge for the generalized nonlinear sigma models. Abdalla, E.; Gomes, M.; Forger, M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701004.

A general criterion for the absence or presence of anomalies in the quantum nonlocal charge of the nonlinear σ-model on a Riemannian symmetric space is presented.

21437 (IFUSP-P—337) Connection between bound-states of bosons moving in one dimension. Coutinho, F.A.B. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jun 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701083.

It is shown that when a system of two identical bosons moving in one dimension have a bound state of energy ν sub(o), then the N body system will also have a bound state at a specific energy given by equation W(N+1) = 2N/1-N]W(N)] - N+1/1-N]W(N-1)].

21438 (IFUSP-P—344) Solitons as Newtonian particles. Eboli, O.J.P.; Marques, G.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701006.

The effect of external electromagnetic fields on non relativistic solitons is studied. Although the solitons are distorted by external fields, they still exhibit a Newtonian behavior. Some explicit examples of such a phenomenon are given, presenting solutions which exhibit Newtonian behavior for simple external fields. Furthermore, general results like charge and flux quantization are shown.

21439 (INIS-mf—8696) 15. and 16. annual seminar on theoretical physics, Johannesburg, 10-12 Jul 1980, Port Elizabeth, 14-16 Jul 1981. (Organization of Theoretical Physicists, Pretoria (South Africa); South African Inst. of Physics, Faure. Subgroup for Theoretical Physics). 1982. 166p. (CONF-8107124—; CONF-8007147—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780102.

From 16. annual seminar on theoretical physics; Port Elizabeth, South Africa (14 Jul 1981).

Separate entries were made in the data base for the in scope papers presented. (WHK)

21440 (ON—03/82) Lagrangian singularities - Applications. Martins, R.V. (Observatorio Nacional, Rio de Janeiro (Brazil)). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701009.

Some results about the behaviour of trajectories of a Hamiltonian system in configuration space is presented. The results are the outcomes of the theories of Lagrangian manifolds and of focal points. Some definitions of the Lagrangian manifold, and Lagrangian singularities are recalled.

21441 (UFRJ-IF—04/83) Electromagnetic equations based on the law of Biot and Savart. Yan, C.C. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701012.

The law of Biot and Savart is given some interpretations that may be of some help in presenting the law. Some possible consequences and the whole set of Maxwell-Lorentz equations are shown to be derivable from the law of Biot and Savart. It is pointed out that the failure or success of deriving the set of Maxwell-Lorentz equation from the law of Biot and Savart is intimately connected to the basic ideas of the theory of special relativity of Einstein.

21442 (UFRJ-IF—05/83) Particle moving in a homogeneous time varying force. Gregorio, M.A.; Castro, A.J. de. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701013.

The problem of a quantum mechanical particle that moves in a spatially uniform time varying field of force is solved in the Schrodinger picture. An explanation on the peculiar behaviour for the spreading of an initial wave packet is given in terms of the dispersion relation obtained in the analytical solution.

21443 **(UFRJ-IF—06/83) Simplified derivation of the Hamilton-Jacobi equation.** Yan, C.C. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701014.

A simple method based on equations of motions is proposed to derive the Hamilton-Jacobi equation for some simple classical mechanical systems.

21444 **(UFRJ-IF—14/83) Cylindrically symmetric cluster in Einstein-Cartan theory.** Bedran, M.L.; Andrade, L.C.G. de. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701018.

A static cylindrically symmetric cluster of particles with spin is studied in the Einstein-Cartan theory. A family of solutions is found where the density of matter, as well as the density of spin, is regular everywhere.

21445 **Solving the Schroedinger equation with use of 1/N perturbation theory.** Mlodinow, L.D.; Shatz, M.P. (California Institute of Technology, Pasadena, California 91125 and Institut des Hautes Etudes Scientifiques, 91440 Bures-sur-Yvette, France). *Journal of Mathematical Physics (New York);* **25**: No. 4, 943-950(Apr 1984). Contract AC03-81ER40050.

The large N expansion provides a powerful new tool for solving the Schroedinger equation. In this paper, we present simple recursion formulas which facilitate the calculation. We do some numerical calculations which illustrate the speed and accuracy of the technique

21446 **Neutron scattering study of MnSi proving no "exchange hole".** Uemura, Y.J.; Majkrzak, C.F.; Shirane, G.; Ishikawa, Y. (Brookhaven National Laboratory, Upton, New York 11973). *Journal of Applied Physics;* **55**: No. 6, 1898-1899(20 Mar 1984). Contract AC02-76CH00016.

Neutron scattering experiments have been performed on MnSi below T/sub C/ with the double-axis powder scattering technique using unpolarized neutrons, and also with the polarization analysis technique. The magnetic scattering intensity has not shown any anomaly around $q = 0.5\ A^{-1}$, in contrast to the previous results of Ziebeck et al. who found a large intensity peak at this momentum transfer. Thus, the hypothesis of Ziebeck et al. of observing an "exchange hole" is excluded.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 21209, 21421

21447 **(CBPF-NF—030/82) Dynamics of non-holonomic systems: the construction of a Lagrangian and a Hamiltonian.** Galvao, C.A.P.; Negri, L.J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700993.

It is shown that once the motion of a non-holonomic system is known it is possible to reduce the system to the holonomic form. A (singular) Lagrangian function and a Hamiltonian which correctly describe the dynamics of the system can be constructed. This procedure is applied to a well known system.

21448 **(CBPF-NF—047/82) Simpler version of PMS application to perturbation theory.** Mignaco, J.A.; Roditi, I. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701000.

A slightly modified approach to the application of the principle of minimal sensitivity (PMS) used to improve results in perturbation theory is presented. Calculations are shown to be easier and essentially give the same results.

21449 **(IFUSP-P—317) Non unitary effects in the time evolution of one body observables.** Nemes, M.C.; Toledo Piza, A.F.R. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Feb 1982. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701002.

A formal derivation of the exact dynamics of the one body density matrix is presented. Its essential ingredients are shown to be: a) a mean field unitary time evolution; b) irreducible non-unitary corrections to the unitary evolution (collision effects); and c) effects due to the time evolution of initial state correlations (which contribute to both (a) and (b)). A qualitative discussion of the importance of collision effects for the expectation values of one body operators, and a quatitative illustration in the framework of an exactly soluble model are given. In this case one finds non unitary contributions as large as 100%.

21450 **(SAND—84-0317C) Adaptive coherence estimation.** Stearns, S.D.; Solomon, O.M. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 5p. (CONF-840576—15). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006486.

From International symposium on circuits and systems - ISCAS'84; Montreal, Canada (7 May 1984).

The process of adaptive coherence estimation, in which adaptive filters are used to obtain the coherence estimate under nonstationary as well as stationary signal conditions, is discussed. A scalar function called the total coherence is introduced and used to illustrate some of the properties and errors in adaptive coherence estimation, particularly the bias error.

21451 **(SAND—84-0413) Local error estimation by doubling.** Shampine, L.F. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1984. Contract AC04-76DP00789. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010107.

Doubling, or Richardson extrapolation, is a general principle for the estimation of the local error made by a one-step method for the numerical solution of the initial value problem for a system of ordinary differential equations. Some contributions are made to the theory of doubling. Principles of comparing explicit Runge-Kutta formulas are reviewed and illustrated in a balanced appraisal of doubling in the context of fourth order formulas. Some apparently contradictory comparisons in the literature are explained.

21452 **(UCID—20041) LLNL Basic Energy Sciences Program in numerical methods for interpolation and approximation FY - 1984.** Carlson, R.E.; Fritsch, F.N. (Lawrence Livermore National Lab., CA (USA)). Mar 1984. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009662.

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The use of approximations in solving real-world problems is probably inevitable. Mathematical models approximate physical reality; computational models approximate the underlying mathematics; and the computer itself only approximates the necessary arithmetic calculations. The numerical methods described in this report involve approximating smooth functions. These approximations are usually found in computational models and take into account the underlying mathematics and the computational realities of working with digital computers. As computer power increases, computational models tend to grow in complexity and size. Consequently, new demands are placed on the approximations to ensure that they faithfully reproduce the properties of the underlying functions. Typical examples of such demands include preserving monotonicity, convexity, and smoothness. Also typical is the need to process larger and larger data sets. Thus, speed and storage constraints never seem to disappear. The goal of this research is to develop sophisticated interpolation/approximation algorithms to meet these new challenges. Some recent results are described.

21453 **Harmonic functions and matrix elements for hyperspherical quantum field models.** Cutkosky, R.E. (Physics Department, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). *Journal of Mathematical Physics (New York);* **25**: No. 4, 939-942(Apr 1984). Contract AC02-76ER03066.

Scalar and vector harmonic functions on the surface of a four-dimensional sphere are discussed. These functions are of use for numerical calculations in a hyperspherical formulation of quan-

tum gauge field models. Formulas are derived for derivatives and integrals involving these functions.

21454 **Dyson representation of SU(3) in terms of five boson operators.** Duendarer, R.; Guersey, F. (Physics Department, Yale University, New Haven, Connecticut 06511). *Journal of Mathematical Physics (New York);* **25**: No. 3, 431-432(Mar 1984). Contract AC02-76ER03075.

A representation of SU(3) in terms of five boson operators is proposed. It is a generalization of the Dyson—Maleev type representation used in nuclear physics with two boson operators related to the integers that label the irreducible representation of SU(3).

21455 **General indices of representations and Casimir invariants.** Okubo, S.; Patera, J. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Journal of Mathematical Physics (New York);* **25**: No. 2, 219-227(Feb 1984). Contract AC02-76ER13065.

A modified definition of the index of degree p of a finite-dimensional representation of a simple Lie algebra is given. The definition applies equally to even and odd p. The correspondence between the earlier definitions of indices (even p) and anomaly numbers (odd p) is pointed out as well as the relation to Casimir invariants of the algebra. A closed formula for the fifth-order index is derived.

70 FUSION ENERGY

21456 **(DOE/ER—0132/1) Technology spinoffs from the Magnetic Fusion Energy Program.** (USDOE Office of Energy Research, Washington, DC. Office of Fusion Energy). Feb 1984. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008873.

This document briefly describes eight new spin-offs from the fusion program: (1) cray timesharing system, (2) CRT touch panel, (3) magneform, (4) plasma separation process, (5) homopolar resistance welding, (6) plasma diagnostic development, (7) electrodeless microwave lamp, and (8) superconducting energy storage. (MOW)

7001 Plasma Research

REFER ALSO TO CITATION(S) 21202, 21583, 21607, 21609, 21611

21457 **(AD-A—134758/2) Observation of magnetic fields in laser-produced plasma using the Zeeman effect. Memorandum report.** McLean, E.A.; Stamper, J.A.; Manka, C.K.; Griem, H.R.; Droemer, D.W. (Naval Research Lab., Washington, DC (USA)). 30 Sep 1983. 30p. (NRL-MR—5161). NTIS, PC A03/MF A01.

The self-generated magnetic field produced when a pulsed Nd:glass laser is focused onto a carbon foil target is measured for the first time using the Zeeman effect. Emission from the CV 1s2s3S sub 1-1s2p3 P sub 2 (2270.9A) was used for the measurement. At a laser irradiance of approx 5 X 10 to the 12th power W/cm2, the distribution to a ring pattern, which caused higher density gradients. A Faraday rotation measurement at approx 200 kG agreed with the Zeeman effect measurement. Opacity effects in the plasma enhanced the sensitivity of the Zeeman measurement.

21458 **(AMPC—14-006) Plasma confinement in self-consistent, one-dimensional transport equilibria in the collisionless-ion regime of EBT operation.** Chang, C.S.; Miller, R.L. (Applied Microwave Plasma Concepts, Inc., Encinitas, CA (USA)). 25 Jul 1983. Contract AC03-82ER51030. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84001861.

It has long been recognized that if an EBT-confined plasma could be maintained in the collisionless-ion regime, characterized by positive ambipolar potential and positive radial electric field, the particle loss rates could be reduced by a large factor. The extent to which the loss rate of energy could be reduced has not been as clearly determined, and has been investigated recently using a one-dimensional, time-dependent transport code developed for this purpose. We find that the energy confinement can be improved by roughly an order of magnitude by maintaining a positive radial electric field that increases monotonically with radius, giving a large ExB drift near the outer edge of the core plasma. The radial profiles of heat deposition required to sustain these equilibria will be presented, and scenarios for obtaining dynamical access to the equilibria will be discussed.

21459 **(CONF-811040—207-Draft) Plasma engineering analyses of tokamak reactor operating space.** Houlberg, W.A.; Attenberger, S.E. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007550.

From 9. symposium on engineering problems of fusion research; Chicago, IL, USA (26 Oct 1981).

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We present a comprehensive method for analyzing the potential physics operating regime of fusion reactor plasmas with detailed transport codes. Application is made to the tokamak Fusion Engineering Device (FED). The relationship between driven and ignited operation and supplementary heating requirements are examined. The reference physics models give a finite range of density and temperature over which physics objectives can be reached. Uncertainties in the confinement scaling and differences in supplementary heating methods can extend or contract this operating regime even to the point of allowing ignition with the more optimistic models.

21460 **(DOE/ER/53113—T2) DDRFP transport code.** Byrne, R.N.; Dobrott, D.; Tamor, S. (Science Applications, Inc., La Jolla, CA (USA)). Sep 1983. Contract AC03-81ER53113. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008573.

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DDRFP is a 1-1/2 dimensional plasma transport code, based on the G2M tokamak code but extended to handle RFPs. The code treats a plasma of ions and electrons whose density and temperature vary across flux surfaces and with time, coupled to a magnetic field. As in G2M, plasma and field are assumed to evolve through a succession of states of pressure balance, and parallel transport is assumed fast enough to keep temperature and density almost constant on flux surfaces. The independent variables are the volume V (per radian) of a flux surface and the time t. Cgs units are used throughout. The primary dependent variables of the code are the electron density n(V,t), the electron pressure P/sub e/(V,t), the ion pressure P/sub i/(V,t), the poloidal flux psi (V,t), and the poloidal current (times $4\pi/c$)f(V,t). We thus need five partial differential equations to advance these five functions. In addition, there are models for subsidiary quantities such as fluxes, ionization states, and neutral densities. These are given in terms of the primary dependent variables.

21461 **(DOE/ER/53150—T3) Reversed-field pinch dynamics and transport studies. Quarterly progress report, third quarter, 20 October 1983-20 January 1984.** Schnack, D.D. (Science Applications, Inc., La Jolla, CA (USA)). 20 Mar 1984. Contract AC03-83ER53150. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009054.

Progress in RFP dynamics and transport studies is described. A three-dimensional, incompressible MHD code has been developed, and is being checked against known results. It is computationally more efficient than the existing code, and will be used extensively if compressibility is determined to be unimportant. Post-processor codes to analyze data generated by the nonlinear code have been developed. Three-dimensional computer runs at low θ(=B/sub θ/(a)/<B/sub z/>) have found the development of a substantial stochastic core, with good flux surfaces being retained in the outer part of the discharge. Runs at high θ have shown complete stochasticity, with reappearance of outer flux surfaces as the modes saturate and relax. Anomalous maintenance of positive toroidal flux arising from a poloidal electric field at the field reversal surface induced by MHD fluctuations (dynamo) has been observed. These results have been documented in a publication. Statistical analysis of stochastic magnetic field regions to assess transport coefficients is underway. Analytic studies of the RFP dynamo are continuing. We are attempting to find steady state solutions with flow

to the resistive MHD equations. Necessary conditions for the existance of the dynamo have been identified. A reduced model to simulate phenomena that occur on the relaxation time scale, such as F-θ current drive, has been derived, and a numerical algorithm formulated.

21462 (DOE/ET/53051—62) **Experimental study of impurity production in the Tokapole II tokamak.** Brickhouse, N.S. (Wisconsin Univ., Madison (USA)). 1984. Contract AC02-76ET53051. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84009659.

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The release mechanism for low-Z impurities in Tokapole II has been characterized through impurity doping and isotopic exchange experiments. The desorption mechanism responsible for the low-Z impurity concentrations during the rise phase of the plasma current depends on the mass of the plasma ions. Doping with small amounts of any gas studied (H_2, D_2, He, N_2, O_2, Ne, Ar, Kr, and Xe) increases the early-time radiation of O, C, and N. For exotic gas doping this increase is linear with the dopant concentration, and proportional to the mass of the dopant, as expected for a momentum transfer process. Isotopic exchange experiments confirm the mass-dependence of oxygen production. A time-dependent coronal model is compared with the vacuum ultraviolet spectroscopic signals of the ionizing oxygen. The quantity σ/tau (desorption cross section divided by particle confinement time) is determined to be 4 x 10^{13} cm^2/msec. The oxygen influx has a large peak early in the start-up.

21463 (DOE/ET/53055—T2) **Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.** Rostoker, N.; Fisher, A.; Robertson, S. (California Univ., Irvine (USA). Dept. of Physics). 1980. Contract AT03-76ET53055. 146p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84009366.

Separate abstracts were prepared for 8 of the included papers. (MOW)

21464 (DOE/ET/53055—T2, pp 10-39) **Observations of the interaction of a rotating relativistic electron beam with a plasma.** Roberson, C.W.; Tzach, D. 1980. NTIS, PC A07/MF A01.

In Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.

A rotating relativistic electron beam is formed by passing a 1 to 1.4 MeV, 50 to 90 kA, 50 nsec annular beam through a magnetic cusp. The beam interacts with a plasma of density 10^{13} to 10^{15} cm^{-3} from a coaxial plasma gun. The plasma response, as measured by magnetic probes, shows oscillations at the Alfven period. The shape of the magnetic probe signals have a remarkable similarity to calculated responses. The beam propagation and profile are measured with collimated x-ray detectors. Magnetic field reversals of 4 to 5 with changes in the magnetic field up to 8 kG are observed in neutral gas.

21465 (DOE/ET/53055—T2, pp 40-55) **Magnetosonic wave emission in cyclindrical geometry: an analytic solution.** Peter, W.; Rostoker, N. 1980. NTIS, PC A07/MF A01.

In Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.

An analytic solution in cylindrical geometry is obtained to the MHD model of N. Rostoker with a finite wall radius. As we let the wall radius approach infinite, previous theoretical results are rederived, thus confirming our solution. Beams with both step-function and sinusoidal rise times are included, and comparisons with experiments, previous theories, and computer codes are presented.

21466 (DOE/ET/53055—T2, pp 56-68) **Thomson scattering data from a plasma heated by a rotating relativistic electron beam.** Robertson, S. 1980. NTIS, PC A07/MF A01.

In Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.

Thomson scattering data from a hydrogen plasma heated by a rotating relativistic electron beam (V $\simeq$ 1 MV, I $\simeq$ 100 kA, tau $\simeq$ 50 nsec) indicate no significant transfer of energy from the beam to the bulk of the plasma electrons for the range of parameters studied (n/sub e/ $\simeq$ 1 - 2 x 10^{14} cm^{-3}). The electron temperature before and after the e-beam was 3 to 7 eV in most cases.

21467 (DOE/ET/53055—T2, pp 82-93) **Plasma heating with a relativistic electron beam at the lower hybrid frequency.** Roberson, C.W. 1980. NTIS, PC A07/MF A01.

In Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.

The electron beam instability at the lower hybrid frequency is discussed as a potential mechanism for heating ions with intense relativistic electron beams.

21468 (DOE/ET/53055—T2, pp 123-135) **Propagation of an intense pulsed ion beam into a magnetic field.** Wessel, F.; Endo, G.; Robertson, S. 1980. NTIS, PC A07/MF A01.

In Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.

We describe an experiment to test the hypothesis that a sufficiently intense ion beam will propagate into a magnetic field by means of self-polarization and E x B drift. The initial measurements of the polarization have yielded the unpredicted result that only positive potentials are created by polarization. This has led to reexamination of the theory and a new criterion for successful injection. Calorimetric and Faraday cup data indicate transmission of the beam several Larmor radii; however, there is significant shot-to-shot variation.

21469 (DOE/ET/53055—T2, pp 136-166) **Plasma motion across a magnetic field.** Peter, W.; Rostoker, N. 1980. NTIS, PC A07/MF A01.

In Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.

We discuss a simple model of a neutralized ion beam propagating across an applied magnetic field by means of an E x B drifting motion. The electric field is produced by the polarization of the beam due to the different ion and electron orbits in the magnetic field. The plasma can cross the field if $\omega/sub\ \pi/^2 >> \Omega/sub\ i/^2$, where $\omega/sub\ \pi/$ is the ion plasma frequency and $\Omega/sub\ i/$ is the ion gyrofrequency. If $\omega/sub\ \pi/^2 << \Omega/sub\ i/^2$, each plasma particle penetrates the field a distance equal to its own gyroradius, and is then reflected.

21470 (DOE/ET/53136—7) **Theoretical aspects of mirror fusion. Annual progress report, 1 April 1983-31 March 1984.** Nicholson, D.R.; Knorr, G.E. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Mar 1984. Contract AC02-82ER53136. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009139.

We have applied the techniques of theoretical and computational plasma physics to two important problems in mirror fusion. First, we have found that electron collisions with neutral gas play an important role in determining the leak width of a cusp confined plasma. Second, we have found that mirror plasmas are susceptible to parametric instabilities during electron cyclotron resonance heating.

21471 (GA-A—17076) **NEUD3: a three-dimensional Monte-Carlo code for calculating the thermal neutral density in tokamaks.** Zawadzki, E.M.; Harvey, R.W. (GA Technologies, Inc., San Diego, CA (USA)). Feb 1984. Contract AT03-84ER53158. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009384.

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NEUD3 is a fully three-dimensional code for calculating the spatial distribution of thermal neutral populations in Doublet III and Big Dee. Input includes the non-circular shape of the plasma flux surfaces and surrounding walls, the density and temperature profiles as flux surface functions, and localized particle source distributions due to gas-puffing or recycling. Test particles are launched from recycling sites and followed through successive charge exchanges and reflections from wall surfaces until ionized. Output includes a summary or detail print file and a plot file.

21472 **(GA-A—17214) Big Dee upgrade of the Doublet III diagnostic data acquisition computer system.** McHarg, B.B. Jr. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 6p. (CONF-831203—128). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009020.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Portions are illegible in microfiche products.

The Big Dee upgrade of the Doublet III tokamak facility will begin operation in 1986 with an initial quantity of data expected to be 10 megabytes per shot and eventually attaining 20 to 25 megabytes per shot. This is in comparison to the 4 to 5 megabytes of data currently acquired. To handle this greater quantity of data and to serve physics needs for significantly improved between-shot processing of data will require a substantial upgrade of the existing data acquisition system. The key points of the philosophy that have been adopted for the upgraded system to handle the greater quantity of data are (1) preserve existing hardware; (2) preserve existing software; (3) configure the system in a modular fashion; and (4) distribute the data acquisition over multiple computers. The existing system using ModComp CLASSIC 16 bit minicomputers is capable of handling 5 megabytes of data per shot.

21473 **(GA-A—17450) Nonlinear theory of lower hybrid current drive II.** Chan, V.S.; Liu, C.S.; Andrews, P.L.; McClain, F.W. (GA Technologies, Inc., San Diego, CA (USA)). Feb 1984. Contract AT03-84ER53158. 17p. (CONF-840311—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007292.

From 4. international symposium on heating in toroidal plasmas; Rome, Italy (21 Mar 1984).

Lower hybrid waves in current drive experiments can cause the electron distribution to become unstable to magnetized plasma waves via the anomalous Doppler resonance. This instability can effectively transfer momentum from high phase velocity LH waves to lower phase velocity plasma waves and also increase the perpendicular tail temperature by wave pitch-angle scattering. Both contribute to a large energetic electron population leading to significant current sustainment. This theory provides good qualitative agreement not only in magnitudes but also in general trends with experimental observations.

21474 **(GA-A—17503) 3-D simulations of limiter stabilization of high-beta external kink-tearing modes.** Lee, J.K.; Ohyabu, N. (GA Technologies, Inc., San Diego, CA (USA)). Mar 1984. Contract AT03-84ER53158. 10p. (CONF-840370—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009400.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

The effects of finite-size poloidal limiters, toroidal limiters, and general mushroom limiters are examined for high-beta finite-resistivity tokamak plamas in free boundary. Even for a linear stability analysis, a 3-D simulation is necessary, in which many poloidal and toroidal modes are coupled because of the limiter constraint and finite-beta. When the plasma pressure and resistivity are small, a poloidal limiter is effective in reducing the growth rate with a small limiter-size, while a toroidal limiter requires a large size for a comparable effect. As the plasma pressure or resistivity increases, a toroidal limiter becomes more effective in reducing the growth rate than a poloidal limiter of the same size. A small optimized mushroom limiter might have a stabilizing effect similar to a conducting shell.

21475 **(INR—529/18) Measurement of velocity of plasma in the plasmotron nozzle and in the free stream of plasma.** Endzheets, G.; Sukever, S. (Institute of Nuclear Research, Warsaw (Poland)). May 1964. 8p. (In Russian). NTIS (US Sales Only), PC A02. Order Number DE84901028.

Paper copy only, copy does not permit microfiche production.

The method for measurement of velocity of plasma inside and outside the plasmotron nozzle as well as for measurement of velocity of plasma from the combustion chamber is described. The method is based on the optical observations of the ion cloud produced in the plasma by the electric discharge. The results of velocity measurements as a function of mass of flow of the stabilizing gas in the plasmotron and of mass of flow of the fuel in the combustion chamber are given.

21476 **(INR—613/9A/PR) Interaction of the fast plasmoids with the barrier of the alternating magnetic field.** Khvashchevski, S. (Institute of Nuclear Research, Warsaw (Poland)). Mar 1965. 8p. (In Russian). NTIS (US Sales Only), PC A02. Order Number DE84901002.

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The effects of the interaction of the fast plasmoids with the pulse high frequency magnetic field barrier were investigated. Depending on the phase and the magnetic field amplitude full reflection, partial penetration, focusing and acceleration of the plasmoids were observed.

21477 **(INR—845/7/PL) Focusing properties of some static nonuniform electric and magnetic fields.** Kulinski, S. (Institute of Nuclear Research, Warsaw (Poland)). 1967. 25p. NTIS (US Sales Only), PC A02. Order Number DE84901008.

Paper copy only, copy does not permit microfiche production .

The motion of a charged particle in the superposition of the electric field of a cylindrical capacitor with the axial homogeneous magnetic field and the magnetic field of line current flowing along the axis of the capacitor, is considered. The equations of trajectories are written in the form of integrals, which are then evaluated approximately, under the assumption of small Larmor radius. Application of the results for coaxial plasma accelerators and rotating plasma devices is briefly considered. The focusing properties of these fields are analyzed in some detail. Particularly, it is shown that the second order focusing can be accomplished providing that the field intensities are properly chosen.

21478 **(LA-UR—84-524) Sustainment dynamo reexamined: nonlocal electrical conductivity of plasma in a stochastic magnetic field.** Jacobson, A.R.; Moses, R.W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840255—17). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007485.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

The plasma dynamo is both an intriguing and a practical concept. The intrigue derives from attempting to explain naturally occurring and man-made plasmas whose strong field-aligned currents j/sub parallel/ apparently disobey the most naive Ohm's law j/sub parallel/ = σ/sub parallel/E/sub parallel/. The practical importance derives from the dynamo's role both in formation and in sustainment of reversed-field pinch (RFP) and Spheromak fusion plasmas. We will examine certain features of the documented quasi-steady discharges on ZT-40M, and RFP in apparent need of a sustainment dynamo. We will show that the tail electrons (which carry j/sub parallel/) are probably wandering (along stochastic B Vector-field lines) over much of the minor radius in one mean-free-path.

21479 **(LA-UR—84-631) One-dimensional transport code for field-reversed configurations.** Caramana, E.J.; Hsiao, M.Y.; Schwarzmeier, J.L. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840255—16). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007449.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

A radial transport code for Field-Reversed Configurations (FRCs) is described. Assuming quasi-neutrality and neglecting inertia and viscous force, the evolution of particle densities, temperatures, and magnetic field through a series of equilibrium states is simulated. To solve the equations, transformations of all dependent variables and the one independent variable are carried out. The processes of interest can be decoupled into two distinctive sets of equations that describe adiabatic and nonadiabatic processes. These sets of equations are then solved by two alternating steps adiabatic and nonadiabatic.

21480 **(LA-UR—84-632) Inappropriateness of the finite Larmor radius model for the tilting mode in field reversed configurations.** Schwarzmeier, J.L.; Seyler, C.E. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840255—15). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007467.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

Numerical results are presented of the finite Larmor radius (FLR) treatment of the tilting mode as described by Seyler and Barnes. We have two principal results. First, the FLR theory of tilting has singularities at the magnetic axis that make application of the theory unphysical. Second, numerical results will be presented showing that for current experiments the magnetic moments of the ions are poorly conserved at the tips of the flux surfaces in an FRC, ad therefore there is a priori reason to view an FLR theory as suspect for global modes in FRCs.

21481 **(LBL—17148) Hopf bifurcation and the beam-plasma instability.** Crawford, J.D. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 35p. (CONF-8307112—2). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008243.

From American Mathematical Society research conference on fluids and plasmas: geometry and dynamics; Boulder, CO, USA (17 Jul 1983).

For finite mode instabilities in dissipative systems, invariant manifold methods allow the bifurcation analysis to be reduced to the locally attracting center manifold. In a kinetic model of electron plasma dynamics, these methods are applied to the one mode beam-plasma instability which occurs via Hopf bifurcation. The instability results in a nonlinear oscillation, and the amplitude equation can be solved to describe the time asymptotic state.

21482 **(ORNL/TM—9034) Technique for measuring the losses of alpha particles to the wall in TFTR.** England, A.C. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009452.

It is proposed to measure the losses of alpha particles to the wall in the Tokamak Fusion Test Reactor (TFTR) or any large deuterium-tritium (D-T) burning tokamak by a nuclear technique. For this purpose, a chamber containing a suitable fluid would be mounted near the wall of the tokamak. Alpha particles would enter the chamber through a thin window and cause nuclear reactions in the fluid. The material would then be transported through a tube to a remote, low-background location for measurement of the activity. The most favorable reaction suggested here is $^{10}B(\alpha,n)^{13}N$, although $^{14}N(\alpha,\gamma)^{18}F$ and others may be possible. The system, the sensitivity, the probe design, and the sources of error are described.

21483 **(PPPL—2060) Energy confinement scaling in tokamaks: some implications of recent experiments with ohmic and strong auxiliary heating.** Goldston, R.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1984. Contract AC02-76CH03073. 52p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009354.

Recent results from confinement scaling experiments on tokamaks with ohmic and strong auxiliary heating are reviewed. An attempt is made to draw these results together into a low-density ohmic confinement scaling law, and a scaling law for confinement with auxiliary heating. The auxiliary heating confinement law may also serve to explain the saturation in tau/sub E/ vs anti n/sub e/ observed in some ohmic heating density scaling experiments.

21484 **(PPPL—2087) Murakami density limit in tokamaks and reversed-field pinches.** Perkins, F.W.; Hulse, R.A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Mar 1984. Contract AC02-76CH03073. 34p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009353.

A theoretical upper limit for the density in an ohmically heated tokamak discharge follows from the requirement that the ohmic heating power deposited in the central current-carrying channel exceed the impurity radiative cooling in this critical region. A compact summary of our results gives this limit n/sub M/ for the central density as n/sub M/ = [Z/sub e//(Z/sub e/-1]/sup 1/2/n/sub eo/ (B/sub T//1T)(1m/R) where n/sub eo/ depends strongly on the impurity species and is remarkably independent of the central electron temperature T/sub e/(0). For T/sub e/(0) ~ 1 keV, we have n/sub eo/ = 1.5 x 10^{14} cm^{-3} for beryllium, n/sub eo/ = 5 x 10^{13} cm^{-3} for oxygen, n/sub eo/ = 1.0 x 10^{13} cm^{-3} for iron, and n/sub eo/ = 0.5 x 10^{13} cm^{-3} for tungsten. The results agree quantitatively with Murakami's original observations. A similar density limit, known as the I/N limit, exists for reversed-field pinch devices and this limit has also been evaluated for a variety of impurity species.

21485 **(PPPL—2088) MHD kink-driven instabilities in net-current-free stellarators.** Rewoldt, G.; Johnson, J.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1984. Contract AC02-76CH03073. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010233.

The Pfirsch-Schlueter current, which is induced in a toroidal device to keep the plasma current diverence-free, is shown to drive a free-boundary instability in a model of a net-current-free ATF-1 stellarator if $<\beta> = 2.6\%$.

21486 **(PPPL—2089) Hamiltonian guiding center drift orbit calculation for toroidal plasmas of arbitrary cross section.** White, R.B.; Chance, M.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1984. Contract AC02-76CH03073. 49p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009355.

A Hamiltonian guiding center drift orbit formalism is developed which permits the efficient calculation of particle trajectories in toroidal devices of arbitrary cross section with arbitrary plasma β. The magnetic field is assumed to be a small perturbation from a zero order toroidal equilibrium field possessing either axial or helical symmetry. The equilibrium field can be modelled analytically or obtained numerically from equilibrium codes. A numerical code based on the formalism is used to study particle orbits in circular and bean-shaped tokamak configurations.

21487 **(PPPL—2091) Direct spectroscopic observation of charge-exchange recombination of medium-Z elements in the PLT tokamak.** Skinner, C.H.; Suckewer, S.; Cohen, S.A.; Schilling, G.; Wilson, R.; Stratton, B. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Johns Hopkins Univ., Baltimore, MD (USA)). Mar 1984. Contract AC02-76CH03073. 17p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010227.

We report the first observation of line emission resulting directly from charge-exchange recombination of medium-Z elements (Al, Sc) injected into a PLT discharge. Transitions due to the radiative cascade immediately following charge-exchange of He-like Al and Sc were observed by a VUV spectrograph and two air monochromators. In two cases, AlXI 3209 A and ScXIX 112.1 A, the observed transition had not previously been experimentally identified. Spatial scans provided information on the profile of the neutral beam in the plasma.

21488 **(PPPL—2093) Coupling to the fast wave via a phased waveguide array.** Olson, L.; McWilliams, R.; Glanz, J.; Motley, R.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Mar 1984. Contract AC02-76CH03073. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009551.

A dielectric-loaded waveguide array has been used to launch fast waves into a plasma in which $\omega/sup\ pi/ < \omega << \omega/sub\ pe/ \sim \omega/sub\ ce/$. The wave propagates when accessibility and cutoff requirements are satisfied. Reflection coefficients as low as 1% have been measured. Use of the fast wave for steady-state current drive is suggested.

21489 **(UCRL—89233) X-ray detection system development for tandem mirror experiment upgrade (TMX-U): hardware and software.** Jones, R.M.; Failor, B.H.; Coutts, G.W. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1984. Contract W-7405-ENG-48. 3p. (CONF-831203—130). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009105.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

This x-ray detection system measures the electron Bremsstrahlung spectrum from the Tandem Mirror Experiment-Upgrade (TMX-U). From this spectrum, we can calculate the electron temperature. The low energy portion of the spectrum (0.5 to 40 keV) is measured by a liquid-nitrogen-cooled, lithium-drifted silicon detector. The higher energy spectrometer uses an intrinsic germanium detector to accommodate the 100 to 200 keV spectra. The system proceeds as follows. The preamplified detector signals are digitized by a high-speed A-to-D converter located in a Computer Automated Measurement and Control (CAMAC) crate. The data is then stored in a histogramming memory via a data router. The CAMAC crate interfaces with a local desktop computer or the main data acquisition computer that stores the data. The software sets up the modules, acquires the energy spectra (with sample times as short as 2 ms) and plots it. Up to 40 time-resolved spectra are available during one plasma cycle. The actual module configuration, CAMAC interfacing and software that runs the system are the subjects of this paper.

21490 **Electron energy distributions using the time-resolved free-bound spectra from coronal plasmas.** Matthews, D.L.; Kauffman, R.L.; Kilkenny, J.D.; Lee, R.W. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Applied Physics Letters;* **44**: No. 6, 586-588(15 Mar 1984). Contract W-7405-ENG-48.

The first subnanosecond, time-resolved, and spatially localized recombination continuum measurements are reported. The possibility of a non-Maxwellian velocity distribution is deduced from the shape of the recombination spectrum that is observed during the time when the plasma is being created by the laser. The cooling rate of the plasma is derived for later times, when no laser heating is present.

21491 **Instrumentation for magnetically confined fusion plasma diagnostics.** Luhmann, N.C. Jr.; Peebles, W.A. (University of California, Los Angeles, California 90024). *Review of Scientific Instruments;* **55**: No. 3, 279-331(Mar 1984). Contract AM03-76SF00010.

Recent progress in magnetically confined plasma research has brought the goal of controlled thermonuclear fusion within reach. Simultaneously, the increased size, temperature, and density of these devices has resulted in rapid changes in diagnostic techniques. In this article, recent developments in instrumentation are reviewed together with trends for the future. The topics discussed include far-infrared laser interferometry and polarimetry, ruby laser television Thomson scattering, excimer and Nd-glass laser scattering, ion temperature determination via large-α scattering with FIR and CO_2 lasers, collective scattering, Schottky diode mixer technology, synchrotron radiation diagnostics and imaging, ion beam probes, x-ray diagnostics and imaging, neutron diagnostics, resonance fluorescence scattering, ultraviolet diagnostics, and internal magnetic field measurement.

21492 **Ballooning spectrum of rotating plasmas.** Hameiri, E.; Laurence, P. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012). *Journal of Mathematical Physics (New York);* **25**: No. 2, 396-405(Feb 1984). Contract AC02-76ER03077.

Ballooning modes are shown to be part of the spectrum by using a "singular sequence" of localized modes. We show that the modes arise from Alfven and slow magnetosonic waves propagating along rays confined inside the plasma. Different ballooning modes are seen, depending on the particular rotating frame of observation, indicating that there are accumulation points of eigenvalues. The effect of rigidly rotating flow is seen to be destabilizing due to an analog of the Rayleigh—Taylor instability associated with density gradients in the presence of a centrifugal force. Flow shear also modifies the stability criterion. A certain component of the flow shear will eliminate the ballooning modes.

21493 **Self-consistent, three-dimensional, electrostatic and magnetostatic tandem mirror equilibria.** Anderson, D.V.; Rensink, M.E. (National Magnetic Fusion Energy Computer Center, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **27**: No. 2, 322-324(Feb 1984). Contract W-7405-ENG-48.

The study of ambipolar electrostatic confinement of central cell ions requires equilibrium models in which the electrostatic forces are treated on an equal footing with the magnetostatic ones. The three-dimensional guiding center fluid equilibrium model has been generalized to include these ambipolar effects; quasineutrality is used to obtain the potential phi. There is no restriction to low-beta or long-thin approximations. In this multiregion, multicomponent model omnigenity is required for each species seprately; this is the less stringent requirement of multigenity.

21494 **Lagrangian formulation of transport theory: Like particle collisional transport and variational principle.** Cohen, R.H.; Hizanidis, K.; Molvig, K.; Bernstein, I.B. (Lawrence Livermore Laboratory, Livermore, California 94550). *Physics of Fluids;* **27**: No. 2, 377-391(Feb 1984). Contract AC02-78ET51013.

A formulation of transport theory, specifically treating like-particle collisions for the lowest collisionality regime, is developed for nonsymmetric geometries, using the Lagrangian picture. This theory provides a particularly simple method for calculating transport coefficients which is useful for devices such as stellarators and tandem mirrors. It is shown that the explicit piece of the transport coefficient, processes such as test particle diffusion $<\Delta psi \Delta psi/\Delta t>$, provides a rigorous upper bound to the full diagonal transport coefficient. The more complex compound, implicit processes (involving perturbed distribution functions and not accessible from a simple Monte Carlo procedure), are always inward (for normal gradients) and can only reduce the full flux from its test particle value. The implicit fluxes have an associated variational principle, maximizing this inward flux. This variational principle differs from the usual minimum principle for entropy production, although the two principles are equivalent, as is shown. An application to systems with weak asymmetry, such as stellarators, bumpy tori, and tandem mirrors is considered.

21495 **Spreading of the distribution function of an ion ring under collisional slowdown.** Ruchti, C.B.; Lovelace, R.V. (Department of Applied Physics, Cornell University, Ithaca, New York 14853). *Physics of Fluids;* **27**: No. 2, 453-457(Feb 1984). Contract AC02-76ET53017.

A study is made of the slowing down of general, self-consistent, large-orbit ion rings due to small-angle Coulomb scattering in a dense, cold plasma. An earlier study was restricted to rings with distribution functions f(P/sub theta/, H) which were narrowly peaked at P/sub theta/ and H, where P/sub theta/ is the single-particle canonical angular momentum and H is the kinetic energy. In the present work, general distribution functions with arbitrary spreads in P/sub theta/ and H are treated by representing f(P/sub theta/, H) as a sum of many delta-function contributions. The self-consistent collisional evolution of the coupled many-delta function system is determined numerically. The reversal factor δ of field-reversed rings is seen to gradually increase initially, as in the earlier study. However, $\delta(t)$ decreases rapidly with time for t>t/sub asterisk/, where t/sub asterisk/ is the time required for the lowest-energy particles to slow down to zero energy.

21496 **Neoclassical transport due to large orbit effects in bumpy tori.** Hastings, D.E. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **27**: No. 2, 458-466(Feb 1984). Contract W-7405-ENG-26.

In an asymmetric device like the ELMO Bumpy Torus (EBT), the radial width of the collision orbits is not determined fully until the self-consistent ambipolar potential is known. There is a class of potentials for which the orbit width is not small compared with the equilibrium scale lengths, thus calling into question standard linear diffusion theory. A diffusion equation is derived in the constants of motion space for a hot minority nearly Maxwellian species undergoing large orbits in a cold dense species. This equa-

tion is solved to all orders in the step-size parameter, and the solution is examined in various limits.

21497 **Nonresonant ELMO Bumpy Torus transport coefficients in the small electric field regime.** Hastings, D.E.; Tolliver, J.S.; Hedrick, C.L. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **27**: No. 2, 467-471(Feb 1984). Contract W-7405-ENG-26.

A conservative BGK collision operator is used to obtain nonresonant neoclassical transport coefficients for a bumpy torus when the delB drift dominates over the E x B drift. Previous nonresonant coefficients have considered the opposite limit. For large collisionalities, the diffusion coefficients are only weakly dependent on the E x B drift, while for small collisionalities, plateau diffusion coefficients are obtained which have an exponential dependence on the E x B drift.

21498 **Suppression of tearing mode growth by externally imposed resonant magnetic islands.** Chu, M.S.; Ikezi, H.; Jensen, T.H. (GA Technologies Inc., San Diego, California 92138). *Physics of Fluids;* **27**: No. 2, 472-474(Feb 1984). Contract AT03-76ET51011.

Externally imposed resonant magnetic islands may be used to slow down the growth rate of the tearing mode via Rutherford's mechanism. However, this is effective only if the harmonic number of the externally imposed islands is sufficiently high.

21499 **Half- and three-halves harmonic measurements from laser-produced plasmas.** Turner, R.E.; Phillion, D.W.; Lasinski, B.F.; Campbell, E.M. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **27**: No. 2, 511-515(Feb 1984). Contract W-7405-ENG-48.

Spectral measurements of the 3/2 harmonic emissions from 1.06 μm irradiated disk targets, and the 1/2 harmonic emissions from 0.53 μm irradiations, are presented. The splitting of the double-peaked spectra show a distinct target Z dependence, for constant laser irradiation parameters. Possible generation mechanisms in terms of the two-plasmon decay instability are discussed.

21500 **MHD beta limits: Scaling laws and comparison with Doublet III data.** Bernard, L.C.; Helton, F.J.; Moore, R.W. (GA Technologies, Inc., San Diego, CA (USA)); Todd, T.N. (Euratom/UKAEA Fusion Association, Abingdon (UK). Culham Lab.). *Nuclear Fusion;* **23**: No. 11, 1475-1484(Nov 1983).

Simple scaling laws for the ideal-MHD β-limit (βsub(c)) as a function of plasma shape parameters (inverse aspect ratio epsilon, elongation kappa, and triangularity delta) in the range covered by recent high-β ($<=4.5\%$) experiments in Doublet III are derived. β-limits are obtained by optimizing the current profile. A large class of profiles is considered. β-limits are presented for a single Gaussian profile as they do not significantly improve with more elaborate profiles. Excluding the region dominated by sawtooth activity, experimental values do not exceed the n=infinity ballooning mode β-limit, but do exceed the n=1 kink mode limit if no wall stabilization is assumed, even in the presence of a cool mantle. If wall stabilization is assumed, the kink limit is above the ballooning limit when the safety factor at the plasma surface (qsub(s)) is greater than two. Even with a fairly close wall, the kink is still unstable when qsub(s)<2. Kinetic effects are not found to significantly improve the ballooning limit in this work. A unified limit curve is postulated which combines the commonly observed hard qsub(s)=2 kink limit with the n=infinity ballooning limit for qsub(s)>2: βsub(c)(%)=27 qsub(s)sup(-1.1)epsilonsup(1.3)kappasup(1.2)(1+1.5delta) for qsub(s)>2 and βsub(c) = 0 for qsub(s)<2. This expression shows that triangularity is almost as important as elongation to reach high β-values.

21501 **Kinetic and resistive effects on interchange instabilities for a cylindrical model spheromak.** Hammett, G.W.; Tang, W.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **23**: No. 11, 1503-1506(Nov 1983).

Letter-to-the-editor.

The stabilizing influence of diamagnetic drift effects on ideal and resistive interchange modes is investigated. A resistive-ballooning-mode equation derived from the gyrokinetic equation is applied to a cylindrical model spheromak equilibrium. It is found that these kinetic effects can significantly improve the beta limits for collisionless interchange stability. For the resistive modes, the diamagnetic drift terms lead to growth rates which scale linearly with resistivity and are considerably reduced in magnitude. However, growth rates for near-term spheromaks remain significant.

21502 **Time and space resolved neutron diagnostic systems for magnetically confined plasmas.** Slaughter, D.R.; Spracklen, H.S.; Delvasto, R. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Instruments and Methods in Physics Research;* **215**: No. 3, 443-452(1 Oct 1983).

With 33 refs.

Neutron spectrometer/counter systems have been developed for diagnostic measurements on magnetically confined deuterium and deuterium-tritium plasmas. An early version was used to determine the mean ion energy as well as the ion-energy confinement time in the endplugs of the Tandem Mirror Experiment. A recent upgrade includes a 10 MHz pulse height analysis and particle identification capability for time- and space-resolved neutron spectrum measurements. Resolution is adequate for a neutron Doppler-width measurement of mean ion energy in near-future confinement experiments such as the Mirror Fusion Test Facility.

21503 **Effects of nonadiabaticity on applications of the ponderomotive force near gyroresonance.** Dimonte, G.; Lamb, B.M.; Morales, G.J. (California Univ., Los Angeles (USA). Dept. of Physics). *Plasma Physics;* **25**: No. 7, 713-722(Jul 1983).

The enhancement of the ponderomotive potential near gyroresonance is investigated both experimentally and theoretically. Due to nonadiabaticity the maximum value of the ponderomotive potential is limited by the transit time of the particle through the R.F. field structure. The results have important implications for isotope separation and R.F. plugging of fusion plasmas.

21504 **Brillouin backscattering in an electron beam-plasma system.** Willett, J.E.; Aktas, Y. (Missouri Univ., Columbia (USA). Dept. of Physics). *Plasma Physics;* **25**: No. 7, 819-825(Jul 1983).

The stimulated Brillouin backscattering of an intense electromagnetic wave propagating in a plasma traversed by an electron beam is investigated. A dispersion relation for the unstable backscattered electromagnetic wave and ion-acoustic scatterer wave in the presence of the pump wave is derived. Formulas are then obtained for the growth rate of the unstable waves and the threshold power of the pump wave required to excite the parametric instability. The results of a numerical study indicate that the electron beam can have a substantial effect on the threshold and growth rate.

21505 **Studies of radio frequency current drive in a plasma.** Bhadra, D.K.; Chu, C.; Harvey, R.W.; Prater, R. (General Atomic Co., San Diego, CA (USA)). *Plasma Physics;* **25**: No. 4, 361-385(Apr 1983).

The physics of radio-frequency current drive for steady-state Tokamak operation is studied in the context of a conceptual small Tokamak, called the RST. Two distinctively different schemes of current drive by using R.F. wave are discussed. In the first, a wave traveling in the toroidal direction damps on the electrons, thereby transferring momentum to the electrons, creating a current; typical of this category is Landau damping of traveling lower hybrid waves. The second general category is called "enhanced bootstrap" current, in which R.F. waves may be used to enhance the cross-field particle diffusion above the neoclassical rate, thereby producing significant enhancement of the plasma bootstrap current at reduced plasma pressure.

21506 **Observations of plasma rotation in the high beta Tokamak Torus II.** Kostek, C.A.; Marshall, T.C. (Columbia Univ., New York (USA). Plasma Physics Lab.; Columbia Univ., New York (USA). Dept. of Applied Physics and Nuclear Engineering). *Plasma Physics;* **25**: No. 4, 421-433(Apr 1983).

Toroidal and poloidal plasma rotation are measured in a high beta Tokamak device by studying the Doppler shift of the 4686 A He II line. The toroidal flow motion is in the same direction as the plasma current at an average velocity of 1.6×10^6 cm s^{-1}, a small fraction of the ion thermal speed. The poloidal flow follows the ion diamagnetic direction, also at average speed of 1.6×10^6 cm^{-1}. In view of certain ordering parameters, the toroidal flow is compared with the predictions of neoclassical transport theory in the collisional regime. For the poloidal motion, however, it is likely that an (Esub(r) x B)/B^2 drift in a positive radial electric field, approaching a stable ambipolar state (STRINGER, 1970) is responsible. Mechanisms for the time evolution of the rotation are also examined. The radial electric field responsible for the (Esub(r) x B)/B^2 drift is determined from the theory using the measured poloidal velocity.

21507 **Effect of ellipticity on the stability of drift waves.** Rosenberg, M.; Waltz, R.E. (General Atomic Co., San Diego, CA (USA)). *Plasma Physics;* **25**: No. 3, 307-316(Mar 1983).

A study of the effect of ellipticity on the stability of drift waves in a sheared magnetic field is presented. The cold-ion fluid equations in an elliptical cylinder are analysed using a ballooning mode formalism. The ellipticity (characterized by an elongation parameter K) causes the modes to be of two types: thin and wide. A condition on K which is sufficient to overcome shear stabilization is found: $K^2 > 1 +$ S-circumflex^2, where S-circumflex = rd ln q/dr is the shear strength parameter. Mode stability due to this effect and its implications for realistic Tokamak parameter regimes is discussed. Even though the destabilization condition can be satisfied over a wide region of the Tokamak for a given ellipticity, it is found that the conditions for strong mode coupling and for the validity of the approximations are satisfied only in a narrow radial region.

21508 **Langmuir probes of general shape and electrode current distribution in a flowing plasma.** Kyrala, A. (Arizona State Univ., Tempe (USA). Dept. of Physics). *Plasma Physics;* **25**: No. 3, 291-306(Mar 1983).

The physical basis of ion collection by a negatively charged Langmuir probe in a quasineutral plasma is elucidated and arguing from the general solution of the stationary collisionless Boltzmann equation the dichotomy of current/voltage relationships below and above saturation voltage is explained.

21509 **Modeling TFTR plasma physics.** Singer, C.E.; Post, D.; Mikkelsen, D.; Seidl, F.; Silverman, A.; Heifetz, D.; Carey, E.; Hulse, R.; Langer, W.; Petravic, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Engineering and Design;* **74**: No. 3, 347-365(Mar 1983).

Recent studies of plasma transport and particle trajectories expected in the Tokamak Fusion Test Reactor (TFTR) have been used to assess plasma performance, to plan for experimental operations, and to make decisions on hardware design and allocation of resources. These studies include definition of a standard plasma transport model, computing the source of fast neutrons which activate the structure, variation of assumptions concerning plasma confinement and impurity influx, definition of the optimum neutral beam pulse length and beamline orientation, investigation of the effects of different heating profiles, investigation of pellet injection, and definition of overall plasma performance and its role in extrapolating TFTR results to design more advanced tokamak reactors.

21510 **Breakdown of Onsager symmetry in neoclassical transport theory.** Molvig, K. (Massachusetts Inst. of Tech., Cambridge (USA); Texas Univ., Austin (USA). Inst. for Fusion Studies); Lidsky, L.M.; Hizanidis, K. (Massachusetts Inst. of Tech., Cambridge (USA)); Bernstein, I.B. (Yale Univ., New Haven, CT (USA)). *Comments on Plasma Physics and Controlled Fusion;* **7**: No. 4, 113-121(Sep 1982).

Neoclassical transport theory is developed in a Lagrangian rather than the usual Eulerian formulation. It is shown that an underlying asymmetry exists in the neoclassical pinch and bootstrap effects and demonstrate the physical basis of the Onsager symmetry relationship in the pinch-bootstrap duality. A simple model calculation shows that low frequency turbulence can destroy the bootstrap current at levels, ephi-circumflex/Tsub(c) approximately 10^{-2}, too low to affect the Ware pinch.

21511 **Parametric excitation of eigenmodes in inhomogeneous media.** Tripathi, V.K.; Papadopoulos, K. (Science Applications, Inc., McLean, VA (USA); Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). *Comments on Plasma Physics and Controlled Fusion;* **7**: No. 4, 123-130(Sep 1982).

It is shown that the parametric excitation of eigenmodes in inhomogeneous media can be analytically described in a compact form without resorting to WKB or any equivalent approximation. This can be accomplished by expanding the pump and one of the decay waves in terms of the eigenfunctions of the inhomogeneous system. The system is truncated by specifying the appropriate resonance conditions. The specific case of stimulated Raman scattering in a parabolic density profile is discussed as an example.

21512 **Relation between Kolmogoroff's theory and the direct interaction approximation in two-dimensional plasma turbulence.** Kulsrud, R.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.); Sudan, R.N. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). *Comments on Plasma Physics and Controlled Fusion;* **7**: No. 2, 47-52(Mar 1982).

The nonlinear damping in a strongly turbulent convecting plasma computed by Kraichnan's modified direct interaction approximation and the power spectrum are rederived in a physically transparent form using Kolmogoroff's theory of turbulence.

21513 **Collective modes with continuous spectra and their interaction with fusion reaction products.** Coppi, B.; Pegoraro, F. (Scuola Normale Superiore, Pisa (Italy); Massachusetts Inst. of Tech., Cambridge (USA)). *Comments on Plasma Physics and Controlled Fusion;* **7**: No. 2, 53-65(Mar 1982).

Consideration is given to the question of whether magnetic fluctuations in confined plasmas are likely to cause a severe deterioration in the containment of the high-energy charged particles produced by fusion reactions. Special attention is devoted to shear-Alfven perturbations with small "azimuthal" wave numbers whose analysis has been the subject of considerable controversy. The spectrum of these fluctuations is shown to be continuous with no regular normal-mode solutions, so that they are rather inefficient at scattering and diffusing the fusion reaction products. This latter conclusion is not changed when terms outside the ideal magnetohydrodynamic description are included (such as finite ion Larmor radius effects, ion viscosity or electron Landau damping).

21514 **Thermal energy transport in plasmas with injected heating.** Coppi, B. (Massachusetts Inst. of Tech., Cambridge (USA)). *Comments on Plasma Physics and Controlled Fusion;* **7**: No. 1, 1-6(Feb 1982).

A diffusion coefficient is proposed that can describe the electron thermal energy transport in confinement experiments where ohmic heating is no longer prevalent.

21515 **Enhanced runaway production by waves in plasmas.** Liu, C.S.; An, Z.G.; Boyd, D.A.; Lee, Y.C. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy); Muschietti, L.; Appert, K.; Vaclavik, J. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). *Comments on Plasma Physics and Controlled Fusion;* **7**: No. 1, 21-28(Feb 1982).

The effects of plasma waves on the runaway production rate is studied. For a wave packet with phase velocities along the electric field containing the critical velocity for runaway, the runaway production rate is found to be enhanced by many orders of magnitude in the presence of plasma waves.

21516 **Alfven wave heating in general toroidal geometry.** Tataronis, J.A. (New York Univ., NY (USA). Courant Inst. of Mathematical Sciences); Talmadge, J.N.; Shohet, J.L. (Wisconsin Univ., Madison (USA)). *Comments on Plasma Physics and Controlled Fusion;* **7**: No. 1, 29-36(Feb 1982).

The continuous spectrum and its relationship to Alfven wave heating is determined for toroidal equilibria that vary in more than one direction, such as tokamaks or stellarators. Using ideal MHD, a set of eigenvalue equations on a given flux surface is derived in terms of two coordinates which span the surface. The nature of the singularity of the eigenfunctions is obtained and the eigenvalues are shown to be real.

21517 **Unstable wave energy transport in a magnetized plasma.** Amendt, P.; Rostoker, N. (California Univ., Irvine (USA). Dept. of Physics); Ron, A. (Technion-Israel Inst. of Tech., Haifa. Dept. of Physics). *Comments on Plasma Physics and Controlled Fusion;* 7: No. 3, 95-102(Feb 1982).

Steady-state cross-field wave energy transport by unstable electrostatic ion-cyclotron waves is shown to be an important process.

21518 **Energy transport: comparison between theory and experiments.** Coppi, B.; Sharky, N. (Massachusetts Inst. of Tech., Cambridge (USA)). *Comments on Plasma Physics and Controlled Fusion;* 7: No. 1, 7-19(Feb 1982).

A search is conducted for a scaling of the electron energy confinement time that gives a good representation of a wide set of experiments carried out in relatively high density, magnetically confined plasmas. The typical parametric dependences of the adopted scaling are found to agree also with those observed in density regimes lower than those analyzed in detail as long as ohmic heating is prevalent for the electrons.

21519 **Particle in a standing wave field; beyond the oscillation center approximation.** Schmidt, G. (Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Physics). *Comments on Plasma Physics and Controlled Fusion;* 7: No. 3, 87-93(Feb 1982).

The ponderomotive force arises in plasma physics as a weak field approximation on particle dynamics. Recent advances in stochasticity theory lead to the conclusion that for sufficiently strong fields, the ponderomotive potential well disappears, and significant portions of phase space are filled with stochastic trajectories. This is illustrated by numerically studying the phase space behavior of the oscillation center.

21520 **Direct method for implicit particle-in-cell simulation.** Friedman, A.; Langdon, A.B.; Cohen, B.I. (Lawrence Livermore National Lab., CA (USA)). *Comments on Plasma Physics and Controlled Fusion;* 6: No. 6, 225-236(Sep 1981).

A new method is described for solving the set of coupled particle and field equations arising in implicit formulations of particle-in-cell plasma simulation. The essence of the method is the linearization of the charge density at the advanced time about an approximate density which does not involve the field at the advanced time; this involves the accumulation of coefficients which are introduced into the elliptic field equation to include the effect of the advanced field. Some illustrative results are presented.

21521 **Nonrandom initializations of particle codes.** Denavit, J.; Walsh, J.M. (Northwestern Univ., Evanston, IL (USA). Dept. of Mechanical and Nuclear Engineering). *Comments on Plasma Physics and Controlled Fusion;* 6: No. 6, 209-223(Sep 1981).

While the most common initialization method for particle codes is the use of random numbers, some concepts of number theory suggest the use of nonrandom, low-discrepancy point sets to achieve quieter initializations. What are low-discrepancy point sets, and what are the results of their applications to simple electrostatic particle simulations.

21522 **Implosion stability and limitations on hollow plasma liners.** Hussey, T.W.; McDaniel, D.H. (Sandia National Labs., Albuquerque, NM (USA)). *Comments on Plasma Physics and Controlled Fusion;* 6: No. 5, 177-185(Aug 1981).

Liner-implosion instabilities, in particular, the hydromagnetic Rayleigh-Taylor instability, are a major question in power concentration and may limit the parameter space in which pulsed electrical energy can be efficiently used. Previously reported simple analytic results indicating the existence of a minimum allowed wavelength are rederived and are verified by two-dimensional MHD calculations. The number of linear e-foldings of this mode, assuming a square current wave form, is then used as a figure of merit for implosion stability. It is shown that this significantly limits design options.

21523 **Charge-exchange pumping of thermalized alpha particles in steady-state tandem-mirror reactors.** Hamilton, G.W.; Logan, B.G. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Comments on Plasma Physics and Controlled Fusion;* 6: No. 4, 139-145(Apr 1981).

Thermal alpha particles can be removed from tandem-mirror reactors (TMR) by charge-exchange on neutral beams injected into the potential wells of thermal barriers. This alpha-removal method has the advantage that 3.5-MeV alphas, magnetically trapped in the central cell, will not be removed until they have transferred almost all their energy to the reacting plasma, which facilitates ignition in the central cell. Under steady-state conditions the thermalized alpha particles will constitute 4% to 10% of the plasma density in a TMR.

21524 **Tokamak plasma heating and current maintenance with intense pulsed ion beams.** Manheimer, W.M.; Winsor, N.K. (Naval Research Lab., Washington, DC (USA)). *Comments on Plasma Physics and Controlled Fusion;* 6: No. 2, 53-57(Dec 1980).

A tokamak plasma can be heated by an intense pulsed ion beam. Depending on the injection scheme, the current can either be maintained or even generated by this beam. In both cases the beam is injected nearly parallel to the field at the start of the discharge.

21525 **Ignition experiments for neutronless fusion reactions.** Atzeni, S.; Coppi, B. (Massachusetts Inst. of Tech., Cambridge (USA)). *Comments on Plasma Physics and Controlled Fusion;* 6: No. 2, 77-90(Dec 1980).

A review is presented of proposed ignition experiments for neutronless fusion reactions.

21526 **Pitch programming of the ZT-S reversed-field pinch experiment.** Jacobson, A.; Burkhardt, L.C.; Baker, D.A.; Howell, R.B.; Schofield, A.E.; Sgro, A.G. (Los Alamos Scientific Lab., NM (USA)). pp 103 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

21527 **Microtearing modes and anomalous transport in tokamaks.** Drake, J.F.; Gladd, N.T.; Liu, C.S.; Chang, C.L. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). pp 143 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

21528 **Experiments on high beta tokamak stability.** Weber, P.G.; Marshall, T.C.; Gross, R.A. (Columbia Univ., New York (USA)). pp 144 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract AC02-76ET53016.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

21529 **Numerical studies of MHD instabilities.** Johnson, J.L.; Chance, M.S.; Dewar, R.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). pp 172 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract AC02-76CH03073.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 19846, 20483, 20484, 20488, 20488, 20496, 20497, 20598, 21457, 21464, 21474, 21509, 21518, 21522

21530 **(ANL/FPP/TM—172) Assessment of tritium breeding requirements for fusion power reactors.** Jung, J. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008988.

This report presents an assessment of tritium-breeding requirements for fusion power reactors. The analysis is based on an evaluation of time-dependent tritium inventories in the reactor system. The method presented can be applied to any fusion systems in operation on a steady-state mode as well as on a pulsed mode. As an example, the UWMAK-I design was analyzed and it has been found that the startup inventory requirement calculated by the present method significantly differs from those previously calculated. The effect of reactor-parameter changes on the required tritium breeding ratio is also analyzed for a variety of reactor operation scenarios.

21531 **(ANL/FPP/TM—179) Modeling the interaction of high power ion or electron beams with solid target materials.** Hassanein, A.M. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009126.

Intense energy deposition on first wall materials and other components as a result of plasma disruptions in magnetic fusion devices are expected to cause melting and vaporization of these materials. The exact amount of vaporization losses and melt layer thickness are very important to fusion reactor design and lifetime. Experiments using ion or electron beams to simulate the disruption effects have different environments than the actual disruption conditions in fusion reactors. A model has been developed to accurately simulate the beam-target interactions so that the results from such experiments can be meaningful and useful to reactor design. This model includes a two dimensional solution of the heat conduction equation with moving boundaries. It is found that the vaporization and melting of the sample strongly depends on the characteristics of the beam spatial distribution, beam diameter, and on the power-time variation of the beam.

21532 **(ANL/FPP/TM—180) X-ray energy deposition and resulting thermal effects in fusion reactor first walls.** Hassanein, A.M. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 23p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009125.

The deposition of X-ray energy resulting from the microexplosion in an inertial confinement fusion reactor and the subsequent thermal response of candidate wall coating and structural materials is examined. Evaporation losses and resulting melt layer thicknesses for these materials exposed to a variety of different X-ray energies and spectra are calculated. Softer X-ray energy spectra absorbed very near the surface are found to cause more evaporation losses but less melting than harder spectra with the same energy content. Substantial differences in the thermal response exist among potential coating materials such as beryllium (low atomic numer, low melting point) and molybdenum and tantalum (high atomic numbers, high melting points). It is found that beryllium can, for a wide range of X-ray energy spectra expected in fusion reactors, resist vaporization losses and resulting melt layer and consequently prolong the lifetime of first walls more than molybdenum and tantalum.

21533 **(CONF-800980—55) LCP heater thermal performance test results and unique test techniques.** Bailey, R.E.; Christensen, E.H. (General Dynamics Corp., San Diego, CA (USA). Convair Div.). 1980. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007241.

From Applied superconductivity conference; Santa Fe, NM, USA (29 Sep 1980).

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The Large Coil Program (LCP) magnet requires integral heaters capable of normalizing conductor half-turns to simulate energy deposition. During a series of tests to determine the cryogenic thermal performance of our LCP conductor, we evaluated the relative thermal performance of two prototype heater installation methods which were tested using a unique heater power control circuit. The prototype heaters were installed in two LCP conductors which were part of a 15-conductor test array used during the conductor thermal performance testing. Results are given comparing the thermal performance of the two heaters, one installed with indium foil and the other soldered with Woods metal. The performance of the Woods metal installation agreed closely to the finite element model predicted conductor thermal response to fast, high-power heater pulses, both in maximum temperature rise and time characteristics of the rise and recovery. The sluggish thermal response of the conductor with the cold-welded indium ribbon-secured heater demonstrated that intimate thermal coupling of the heater elements to the conductor is mandatory. The heater control circuitry is described which was developed in support of this test and provided transient heater power durations down to 5 msec and at power inputs up to 3000 watts. A brief description also is given of the transient and steady-state data acquisition systems used as well as the interface between the heater control circuitry and the remote computer used to control the transient testing.

21534 **(CONF-811040—208-Draft) Cryogenic voltage withstand and heat transfer tests for the General Electric large coil turn heaters.** Schwenterly, S.W.; Fitzpatrick, C.M.; Court, W.R. (Oak Ridge National Lab., TN (USA); General Electric Co., Schenectady, NY (USA). Research Lab.). 1981. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007535.

From 9. symposium on engineering problems of fusion research; Chicago, IL, USA (26 Oct 1981).

The cryogenic hipot tests indicate that undamaged heaters will perform acceptably in the coil. However, the 1050 V dc hi-pot test does not appear adequate to diagnose all flaws. It was decided that during coil production the heaters will be tested with at least 1400 V dc and 400 V ac. Further tests at lower voltages will be performed after the heated conductor section is wound into the coil, with a final test at the layer of 900 V dc or 1.5 times the operating voltage. On the basis of the heat transfer tests, the power supply for the heaters will be specified to provide voltage pulses of up to 1000 V at 60 A for a maximum of 1 sec.

21535 **(CONF-811040—209) Mechanical stresses in solenoids constructed of transversely isotropic materials.** Gray, W.H.; Cain, W.D. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007548.

From 9. symposium on engineering problems of fusion research; Chicago, IL, USA (26 Oct 1981).

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Equations relating the mechanical stress, strain, and displacement of elastic, axisymmetric solenoid magnets to the solenoid's geometry, current density, magnetic field, and material properties have been derived by several authors. For the special case of rotational transverse isotropy, these equations are singular for certain values of the ratio of the orthotropic elastic moduli. This paper discusses the mathematical conditions for which a singularity of this type exists and presents a general solution to these equations at their singular points.

21536 **(CONF-811040—210-Draft) Method for transmitting analog data over a fiber-optic link.** Dyer, G.R. (Oak Ridge National Lab., TN (USA)). Oct 1981. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006578.

From 9. symposium on engineering problems of fusion research; Chicago, IL, USA (26 Oct 1981).

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The transmission of high-speed analog data across an insulating break is a common requirement for present fusion experiments, and it will be a necessity for a reactor-like device. Presently available systems tend to be complex, slow, and expensive. A method is described for implementing a fiber-optic link with analog data input and output. Two realizations of the method are given. A medium-speed system using monolithic circuitry is capable of a dc to 20-KHz bandwidth with excellent linearity and a dynamic range of at least 60 dB. A higher-speed system uses some discrete circuitry to attain a 500-KHz bandwidth with at least a 40-dB dynamic range. Both systems use a relatively inexpensive digital optical link kit combined with a duty cycle modulation scheme for data transmission. This method achieves accurate reproduction of complex waveforms without introducing the quantization errors inherent in analog-to-digital conversion, offers bipolar response with low offset and drift, and maintains a constant bandwidth regardless of signal level.

21537 **(CONF-811101—35) Large-scale structural analysis of the Large Coil Test Facility.** Gray, W.H.; Baudry, T.V. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007559.

From Winter annual meeting of the American Society of Mechanical Engineers; Washington, DC, USA (15 Nov 1981).

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NASTRAN automatic substructuring was chosen as the finite element method to be used for the Large Coil Test Facility (LCFT) test stand design analysis. This paper describes some of the practical aspects of the test stand structural analysis. The LCTF test stand analysis involves extensive consideration of the usefulness of substructuring, the effectiveness of vendor-supplied and locally developed pre- and postprocessing finite element software, and the efficient utilization of limited computing resources. These considerations plus the analysis problems encountered during the LCTF test stand large-scale analysis are addressed in this paper.

21538 **(CONF-840265—1) Recent progress on ATF.** Neilson, G.H. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007523.

From US-Japan workshop on heliotron-E results; Kyoto, Japan (13 Feb 1984).

The ATF experiment will test improvements to high-beta, steady-state toroidal confinement using external helical fields. The device design has been optimized to (1) provide direct access to the high-beta second-stability regime, (2) have sufficient flexibility to study a large range of toroidal configurations both with and without plasma current, (3) test the reduction of low-collisionality transport by EXB drifts induced by the self-consistent radial electric field, and (4) permit steady-state, high-beta operation without disruptions. Continued physics studied at ORNL and recent results from foreign stellarator experiments have increased confidence in ATF performance.

21539 (DOE/ET/53055—T2, pp 96-101) **Reverse magnetic fields in a plasma using microsecond rotating electron beam.** Saenz, G.; Roberson, C.W. 1980. NTIS, PC A07/MF A01.

In Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.

We have observed field reversals up to 2.5 the initial magnetic field in a plasma filled magnetic mirror using a microsecond rotating electron beam. Hard x-ray measurements show the reverse fields are due to beam electrons rather than induced plasma currents.

21540 (DOE/ET/53055—T2, pp 105-122) **Generation of a closed, field-reversed magnetic configuration by an electron beam launched from a magnetized cathode.** Robertson, S.; Endo, G. 1980. NTIS, PC A07/MF A01.

In Study of plasma heating by intense relativistic electron beams. Final technical report, February 1, 1979-September 30, 1980.

A closed, field-reversed magnetic configuration has been created in 180 mTorr initially unmagnetized neutral hydrogen gas by return currents from an 880 kV, 80 kA, 50 nS electron beam launched from a cathode mounted upon a field coil momentarily energized by the beam current. A detailed radial magnetic profile was obtained indicating a central field of 5 kG decreasing through zero to -0.4 kG at radii of 3 to 6 cm. The central field decayed with a time constant of 5 μS. Flux conservation by the metal vacuum chamber insured a configuration in which field lines did not intersect walls.

21541 **(DOE/NBM—4007520) Be-limiter experiment on ISX.** Mioduszewski, P.K. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007520.

Handwritten manuscript.

The relevance of this experiment to the JET experiment is described. Data on the following issues are given: (1) thermo-mechanical properties of the Be-limiter; (2) particle flow to limiter; (3) heat flow to the limiter; (4) limiter-plasma-wall interaction; (5) plasma properties/operation; (6) active control of plasma-limiter operation; and (7) fault conditions. (MOW)

21542 **(DOE/NBM—4007536) Improved computer modelling of magnetron injection guns for gyrotrons.** Caplan, M.; Thorington, C. (Hughes Aircraft Co., Torrance, CA (USA). Electron Dynamics Div.). 1984. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007536.

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A variable mesh finite-element electron gun design code has been developed to simulate hollow beams produced by magnetron injection guns. Very accurate solutions of the self-consistent space charge forces are obtained by using a computational mesh, distorted in a way which allows a high density of mesh points within the hollow beam. A generalized hybrid model for cathode emission has been incorporated which combines temperature limited and space charge limited emission in a way justified from empirical and physical arguments. Beam characteristics of a magnetron injection gun are presented as the transition from temperature limited to space charge limited operation is made. Limited comparisons with experimental results are presented.

21543 **(DOE/NBM—4009153) TRIO-01 experiment.** Clemmer, R.G.; Finn, P.A.; Billone, M.C.; Misra, B.; Greenwood, L.R.; Dyer, F.F.; Dudley, I.T.; Bate, L.C.; Clemmer, E.D.; Fisher, P.W. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 10 Feb 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009153.

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The TRIO-01 experiment was designed to test in-situ tritium recovery and heat transfer performance of a candidate solid breeder, γ-$LiAlO_2$. The results showed that nearly all the tritium generated was recovered. Only <0.1 wppM tritium remained in the solid after irradiation testing. The heat transfer performance showed that temperature profiles can be effectively controlled.

21544 **(EGG-M—10783) Preconceptual design and analysis of a solid-breeder blanket test in an existing fission reactor.** Deis, G.A.; Hsu, P.Y.; Watts, K.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 5p. (CONF-831203—114). NTIS, PC A02; 3; GPO Dep. Order Number DE84005053.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Preconceptual design and analysis have been performed to examine the capabilities of a proposed fission-based test of a water-cooled Li_8O blanket concept. The mechanical configuration of the test piece is designed to simulate a unit cell of a breeder-outside-tube concept. This test piece will be placed in a fission test reactor, which provides an environment similar to that in a fusion reactor. The neutron/gamma flux from the reactor produces prototypical power density, tritium production rates, and operating temperatures and stresses. Steady-state tritium recovery from the test piece can be attained in short-duration (5-to-6-day) tests. The capabilities of this test indicate that fission-based testing can provide important near-term engineering information to support the development of fusion technology.

21545 **(GA—A17325) Advanced ICRF launchers for heating and current drive in large tokamaks.** Chiu, S.C.; Blau, F.P.; Chan, V.S.; Moeller, C.P.; Parks, P.B.; Rawls, J.M.; Perkins, F.W. (GA Technologies, Inc., San Diego, CA (USA)). Jan 1984. Contract AT03-84ER53158. 22p. (CONF-840149—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009092.

From IAEA technical committee meeting; Princeton, NJ, USA (16 Jan 1984).

Two new types of ICRF launcher concepts have been analyzed for tokamak reactor applications. The first type, termed the resonant coil cavity, offers the advantages of (1) convenient and flexible sizing, (2) ease of operation and maintenance, and (3) high power handling capability. Mode structures, resonance conditions, power handling capabilities, and sensitivity to changes in plasma conditions have been studied and results indicate this to be a promising launching structure in both present-day devices and tokamak reactors. The second type is the Yagi-Uda type of slow wave structure which has the advantages of (1) protection from the plasma, and (2) well defined and adjustable traveling wave k/sub parallel/-spectrum for possible current drive studies. Variations of the k/sub parallel/-spectrum and loading with array dimensions and plasma parameters have been calculated. Results indicate that this structure is not feasible for present generation tokamaks because of radial accessibility. There is, however, a window of applicable parameters for reactor-type tokamaks.

21546 **(GA-A—17174) Overview of fusion and the related computer systems at GA Technologies Inc.** Henline, P. (GA Technologies, Inc., San Diego, CA (USA)). Sep 1983. Contract AT03-76ET51011. 15p. (CONF-8309222—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009018.

From 7. Europe and row annual muse meeting; London, UK (27 Sep 1983).

GA Technologies Inc. has been a leader in the field of fusion research since 1961. To understand the reactions occurring in a tokamak, diagnostic measurements which gather a large amount (4 Mbytes) of data are made. A MODCOMP 7870 dual-CPU system using CAMAC interfacing to hardware device and microcomputers gathers the data, performs local analysis, and archives the data to a DEC system-10. The MODCOMP system must be able to do all tasks in a five-minute period. The emphasis is on acquisition and archiving, and some important calculations are done in real-time. The lengthy and more precise analysis is done on the DECsystem-10, where all shots may be accessed.

21547 **(GA-A—17212) Upgraded waterflow calorimetry for a total beam energy system for doublet III neutral beams.** Garcia, J.R.; Hong, R.M.; Treglio, J. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 5p. (CONF-831203—124). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009039.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The waterflow calorimetery system is a diagnostic experiment for the Doublet III neutral beam injectors at GA Technologies, Inc. The system measures the deposition of beam energy on various beam apertures and dumps. The upgraded waterflow calorimetry system has been designed to overcome these difficulties by discarding the multiplexer and individual waterflow modules, and utilizing an LSI 11/23 based mircocomputer for data acquisition and analysis for four neutral beamlines. Compensation for the cold water temperature drift in the energy calculations is done by the microcomputer software. The microcomputer allows for data analysis offline and during data acquisition and for data archiving to disk with magnetic tape backup available.

21548 **(GA-A—17373) Production and test results for the C + SiC alloy coating for the 60 tile beam armor/limiter array in Doublet III. Annual report, January 1, 1983-September 30, 1983.** Hopkins, G.; Trester, P.; Kaae, J. (GA Technologies, Inc., San Diego, CA (USA)). Nov 1983. Contract AT03-76ET51011. 41p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009666.

Sputtering characteristics of this C + SiC alloy material have been measured with hydrogen ion beams and an almost complete suppression of chemical sputtering (methane formation) has been observed at tempertures below 1000°C. This accounts for its excellent erosion resistance compared to carbon. An electron beam has been uesd to simulate the thermal pulse response of the coating to normal discharges in Doublet III. Heat loads up to 20 kW/cm^2 for up to 0.5 sec were employed. The coating survives up to the limit of graphite substrate for the Doublet III tile design. Heat loads from disruptions (up to 5 MJ/cm^2, 100 μs) were simulated with a 30 nsec laser beam pulse of 0.3 MJ/m^2. A large fraction of the energy was absorbed in vaporization of about 10 μm of the surface material with no observable damage to the underlying remaining material ($\sim$ 90 μm). This indicates excellent resistance to disruptions.

21549 **(GA-A—17375) Preliminary design of a 20 MW ICRF power system for Doublet III-D.** Remsen, D.B.; Rawls, J.M. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 6p. (CONF-831203—135). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009472.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The heating of plasmas by waves in the ion cyclotron frequency regime is now the preferred approach for driving tokamak reactors to ignition conditions. Among the notable advantages of this approach are ready penetration into a thermonuclear plasma and an established technology for power generation. An ICRF power system for DIII-D (Doublet III reconfigured with a large dee-shaped vacuum vessel) has been designed to test the feasibility of employing such heating in a reactor. The system proposed is a narrow band rf generator operating at 55 and 40 MHz constructed in modules capable of delivering 1.25 MW each. A 20 MW, 10 s system is planned for the program envisioned. A system description is presented inclusive of rf excitation through final power amplifiers. The system layout of equipment within the D-III facility is also described. The modular nature of the total system facilitates meaningful testing at intermediate power levels, future system enlargement, and even reuse of the hardware on other facilities.

21550 **(HEDL—7436) Reduced activation activities.** Garner, F.A.; Brager, H.R.; Gelles, D.S. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-70FF02170. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008506.

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Four low activation alloy classes, two austenitic and two ferritic, have been incorporated into the MOTA-1B experiment in the FFTF reactor to provide an early assessment of the suitability of such alloys for reactor service.

21551 **(HEDL—7437) Contribution to 6th annual report on special purpose materials for magnetically confined fusion reactors: solid breeder materials.** Hollenberg, G.W.; Baldwin, D.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008181.

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Separate abstracts were prepared for each of the three included papers. (MOW)

21552 (HEDL—7437, pp 8p, Paper 1) **Tritium/helium release from Li_2O, $LiAlO_2$, Li_4SiO_4 and Li_2ZrO_3.** Hollenberg, G.W.; Baldwin, D.L. 1984. NTIS, PC A03/MF A01.

In Contribution to 6th annual report on special purpose materials for magnetically confined fusion reactors: solid breeder materials.

Helium/tritium measurements have been conducted on Li_2O, $LiAlO_2$ and Li_4SiO_4 after irradiation in EBR-II. The tritium retention of Li_2O is lower than that of $LiAlO_2$ or Li_2SiO_3, while the helium retention of Li_2O is higher than that of the other solids. The acid dissolution technique for helium/tritium measurement has been dropped in favor of a high temperature fused salt dissolution technique.

21553 (HEDL—7437, pp 11p, Paper 3) **Irradiation effects on Li_2O, $LiAlO_2$, Li_4SiO_4 and Li_2ZrO_3.** Hollenberg, G.W. 1984. NTIS, PC A03/MF A01.

In Contribution to 6th annual report on special purpose materials for magnetically confined fusion reactors: solid breeder materials.

Four solid breeder materials, i.e., Li_2O, Li_4SiO_4, Li_2ZrO_3 and $LiAlO_2$, have been irradiated to a burnup of $\sim 3 \times 10^{20}$ captures/cm^3 at temperatures of 500°C, 700°C and 900°C. All materials, except for Li_2O, exhibited excellent dimensional stability. Li_2O pellets swelled diametrically from 1.5% to 1.8% in the 700°C and 900°C temperature range. In addition, the Li_2O pellets experienced significant grain growth (from 3 μm to 17 μm) during the irradiation while the other materials were essentially unchanged. The capsules containing Li_2O also showed evidence of vapor phase transport to the capsule walls, especially at 900°C ($\Delta W/W \cong 0.5\%$) whereas no transport was observed in capsules containing the other materials. In many ways, Li_2O appeared less stable during irradiation than the ternary oxides. The poor stability of Li_2O is contrasted with its superior breeding ratio so that its dominance in blanket designs may be in question.

21554 (IAE—3604/11) **Possible ways of simulation studies of radiation damage in fusion reactor materials.** Al'tovskij, I.V.; Zhukova, T.I.; Orlov, V.V.; Trunov, A.M.; Turchin, S.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700747.

Capabilities of different experimental devices were analyzed and a number of suggestions of principal directions in the development of the experimental basis for radiation materials investigations for a thermonuclear reactor (TNR) was worked out. The analysis performed has shown that the irradiation with protons over 30 MeV at a current density of about 500 μAxcm^{-2} is most effective. Deuterons and alpha particles can be also considered to be perspective. Use of heavy ions permits to obtain high displacement rates at a depth not exceeding grain size. Application of hard gamma radiation with 15 MeV channeled electron beams makes it possible to produce a fast neutron source of intensity not less than 3x1D^{14} neutr./s per 1 mA current of approximately 200 MeV electrons.

21555 (IPPJ—551) **Proceedings of workshop on first wall coating.** Kamada, K.; Fukutomi, M. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1982. 233p. (CONF-8011204—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780099.

From Workshop on first wall coating; Nagoya, Japan (28 Nov 1980).

Abstracts of individual items from the proceedings were prepared separately for the data base. (GHT)

21556 (JAERI—1280) **Graphical representation of transmutation and decay chain data, transmutation cross section and delayed gamma ray emission data.** Seki, Yasushi; Iida, Hiromasa; Kawasaki, Hiromitsu. (Japan Atomic Energy Research Inst., Tokyo). Sep 1982. 255p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84700717.

In a D-T burning fusion reactor, the neutron induced activity severely limits personnel access to the reactor. Accurate evaluation of the induced activity and dose rate is necessary to conduct effective biological shield design. In order to evaluate the dose rate accurately, considerable amount of activation data is required. This report gives graphical representation of transmutation and decay chain data, transmutation cross section data and delayed gamma ray emission data for 116 nuclides of interest in terms of fusion reactor design. This graphical representation was made with hope of producing a reference for examining activation problems. It has already been shown to be effective in correcting inappropriate data. A computer code AMOEBA developed for the checking and plotting of the activation data is also described in this report.

21557 (JAERI-M—82-123) **Secondary electron emission rate under the electron bombardment, (1). Outline of the experimental apparatus and some experimental data.** Ogiwara, Norio; Arai, Takashi; Kishida, Haruo. (Japan Atomic Energy Research Inst., Tokyo). Sep 1982. 27p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700719.

Plasma-wall interaction is one of the serious problems to the plasma fusion devices such as JT-60. This interaction is approached with the following two steps; first, it is devided into fundamental processes and they are studied individually, then, the relationship between the plasma parameters and the wall properties is investigated. At present, we may stand on the first step. Now, we have studied the secondary electron emission, which is one of the fundamental processes. Secondary electron emission rate and the electron temperature of plasma boundary decide the sheath potential which is one of the most important parameters of the edge plasma. Whichever the primary beam is made of ion or electron, we are doubtful of the previous data because they are measured over the energy range of fusion research and the surface conditions are not clearly identified. Therefore, we have producted the experimental apparatus and measured the secondary electron emission rate of various materials under the electron bombardment in the energy range of less than 1 keV. In this report, the experimental apparatus is outlined and the some experimental data are shown. On the cases of sus304 and Mo, we have confirmed the universal curve for the yield of secondary electron emission. In accordance with cleanliness of the surface, the secondary electron emission rate is gradually decreased to the constant value. In the energy range of between 150 -- 200 eV and 1 keV, we have the secondary electron emission rate over than 1 from the clean surfaces of both sus304 and Mo. Their maximum secondary electron emission rate γsub(m) and the corresponding energy E sub(m) are following; γsub(m) = 1.12, E sub(m) = 360 eV for sus304, and γsub(m) = 1.23, E sub(m) = 410 eV for Mo, respectively.

21558 (JAERI-M—82-194) **Water adsorption on lithium oxide pellets in helium sweep gas stream.** Yoshida, Hiroshi; Konishi, Satoshi; Takeshita, Hidefumi; Kurasawa, Toshimasa; Ohno, Hideo; Katsuta, Hiroji; Watanabe, Hitoshi; Naruse, Yuji. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 55p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700743.

Adsorption characteristics of water vapor on lithium oxide pellets in the helium gas stream was experimentally studied to give a technological information on the tritium inventory and operating conditions for a helium sweep type fusion blanket design. Adsorption experiments were performed by using an isothermal dynamic adsorption apparatus with a Li_2O pellet packed column. Dimensions of the packed bed were 4.8 cm sup(H) x 1.65 cm sup(ID), temperature of the bed was 670 -- 830 K, feed concentration of water vapor in ehlium was 0.1 -- 14000 ppm, space velocity in the bed was 2500 -- 5000 hr^{-1}. Bulk density and specific surface area of the pellets, which were fabricated by sintering method with argon gas atmosphere, were 82 -- 83%TD and 0.57 m^2/g-Li_2O, respectively. The amount of water vapor adsorbed on the Li_2O pellets was represented by the following experimental equation.

21559 (LA-UR—84-630) **Transport, stability and relaxation of a spheromak.** Sgro, A.G.; Marklin, G.; Mirin, A.A. (Los Alamos National Lab., NM (USA); Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840255—11). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007285.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

We consider a zero-β spheromak contained in a rectangular region having perfectly conducting boundaries in its minimum energy state, and we calculate its evolution. Our results may be summarized as follows. Since this state is a stable equilibrium, the initial evolution of the plasma is caused by diffusion. We simulate this using a transport code. We find that q at the magnetic axis drops and q(r) becomes flat. When q on axis drops below 0.5, the spheromak becomes unstable to an n = 2 kink. The plasma is then modeled dynamically; the kink displacement saturates and eventually reverses when a reconnection occurs. A new magnetic axis begins to form as the plasma relaxes toward a minimum energy state.

21560 **(LBL—17017) Review of negative ion source technology.** Leung, K.N. (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 7p. (CONF-831203—113). NTIS, PC A03; 3; GPO Dep. Order Number DE84006769.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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H^- or D^- ions are required for generating high energy neutral beams in heating fusion plasmas. Two distinct types of H^- ion sources can be identified: (1) surface sources - in which the H^- ions are generated by particle collisions with low work function metal surfaces; and (2) volume sources - in which the H^- ions are produced by electron-molecules and electron-ion collision processes in the volume of a hydrogen discharge. Recent experiments demonstrate that reasonable H^- ion current density can be obtained from both types of sources. However, further technology must be developed on the control of cesium and the reduction of electron drain before these sources become practical units of a multi-ampere neutral beam injection system.

21561 **(NRL-MR—5221) Absolutely uniform illumination of laser fusion pellets.** Schmitt, A.J. (Naval Research Lab., Washington, DC (USA)). 17 Feb 1984. Contract AI08-79DP40092. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009387.

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Absolutely uniform illumination of spherical laser fusion pellets is possible when the energy deposition from a single laser beam is given by a simple $\cos^2\theta$ distribution. Conditions can be derived for which the laser beam targeting angles allow this absolute illumination uniformity. Configurations based upon the cube and higher order Platonic solids satisfy the constraints, as well as infinite class of other less symmetric configurations.

21562 **(ORNL/TM—8994) Alloy development for fast induced radioactivity decay for fusion reactor applications.** Klueh, R.L.; Bloom, E.E. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009111.

The Cr-Mo ferritic (martensitic) steels and austenitic stainless steels (primarily type 316 and variations on that composition) are the leading candidates for the structural components for future fusion reactors. However, irradiation of such steels in a fusion environment produces long-lived radioactive isotopes. These isotopes lead to difficult radioactive waste disposal problems once the structure is removed from service. Such problems could be reduced by developing steels that contain only elements that produce radioactive isotopes that decay to low levels in a reasonable time (tens of years instead of hundreds or thousands of years). This report discusses the development of such steels by making elemental substitutions in the steels now under consideration. Molybdenum must be replaced in the Cr-Mo steels; nickel and molybdenum both must be replaced in the austenitic stainless steels (the nitrogen concentration must be limited, and niobium, maintained to extremely low levels). Appropriate substitutions are tungsten for molybdenum in the Cr-Mo steels and manganese for nickel in the austenitic stainless steels. Indications are that suitable ferritic steels can be developed, but development of a nickel-free austenitic stainless steel with properties similar to the Cr-Ni stainless steels appears to be much more complex.

21563 **(PPPL—2075) Depolarization of D-T plasmas by recycling in material walls.** Greenside, H.S.; Budny, R.V.; Post, D.E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1984. Contract AC02-76CH03073. 43p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84010232.

The feasibility of using polarized deuterium (D) and tritium (T) plasmas in fusion reactors may be seriously affected by recycling in material walls. Theoretical and experimental results are reviewed which show how the depolarization rates of absorbed D and T depend on first wall parameters such as the temperature, the bulk and surface diffusivities, the density of electronic states at the Fermi surface, the spectral density of microscopic fluctuating electric field gradients, and the concentration of paramagnetic impurities. Nuclear magnetic resonance (NMR) spectroscopy of hydrogenated and deuterated amorphous semiconductors suggests that low-Z nonmetallic materials may provide a satisfactory first wall or limiter coating under reactor conditions with characteristic depolarization times of several seconds. Experiments are proposed to test the consequences of our analysis.

21564 **(PPPL—2092) DAS performance analysis.** Bates, G.; Bodine, S.; Carroll, T.; Keller, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1984. Contract AC02-76CH03073. 50p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009550.

This report begins with an overview of the Data Acquisition System (DAS), which supports several of PPPL's experimental devices. Performance measurements which were taken on DAS and the tools used to make them are then described.

21565 **(SAI—83/1013-APPAT-20) Deuterium-based fuel cycle optimization.** Shuy, G.W.; Dobrott, D. (Science Applications, Inc., La Jolla, CA (USA). Applied Plasma Physics and Technology Div.). Oct 1983. Contract AC03-81ER53113. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010104.

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Modifications of Cat-d and d-t fuel cycles are investigated. The Cat-d cycle is modified by adjusting the ^{3}He concentration to obtain maximum fusion or net power density (P/sub f/, P/sub net/) as a function of plasma temperature. The fuel cycle is further modified by means of adding tritium. The impact on the P/sub f/, the P/sub net/, the n tau requirements and required tritium breeding ratio is determined. The d-t cycle is also modified by reducing the tritium concentration. The results of this reduction are discussed.

21566 **(SAND—83-2564C) Linear stability of general magnetically insulated electron flow.** Swegle, J.A.; Mendel, C.W. Jr.; Seidel, D.B.; Quintenz, J.P. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 4p. (CONF-8404109—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010148.

From IEEE symposium on security and privacy; Oakland, CA, USA (30 Apr 1984).

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We have formulated a linear stability theory for magnetically insulated systems by linearizing the general 3-D, time-dependent theory of Mendel, Seidel, and Slutz. In the physically interesting case of electron trajectories which are nearly laminar, with only small transverse motion, we have found that several suggestive simplifications occur in the eigenvalue equations.

21567 **(UCID—19975) Fusion power demonstration: baseline report.** Henning, C.D.; Logan, B.G.; Neef, W.S.; Dorn, D.W.; Clarkson, I.R.; Carpenter, T.J.; Gordon, J.D.; Campbell, R.B.; Hsu, P.Y.; Nelson, W.D. (Lawrence Livermore National Lab., CA (USA)). Jan 1984. Contract W-7405-ENG-48. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84008827.

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An overview is given of the FPD project. A technical discussion of the primary independent plasma parameters, the physics constraints that limited the allowed combinations of those param-

eters for ignition, and the basic plasma scaling laws that govern FPD plasma parameters are described. Plans are detailed for phased construction and operation of FPD. The components for FPD are based on those designed for the Mirror Advanced Reactor Study (MARS). Although FPD costs are based on the MARS first-of-a-kind estimates, FPD contains design modifications made to reduce these costs. The preliminary results of siting and safety studies are described. An essential element of FPD design is the ability to perform remote maintenance on the equipment. The key research and development issues associated with the design and implementation of an FPD facility are highlighted.

21568 **(UCID—20040) Fusion materials science at reactor 14-MeV neutron fluxes: upgrading RTNS targets into the multi-megawatt/m² regime.** Tuckerman, D.B. (Lawrence Livermore National Lab., CA (USA)). 16 Mar 1984. Contract W-7405-ENG-48. 24p. NTIS, PC A02; 3; GPO Dep. Order Number DE84008818.

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The Rotating Target Neutron Source-II (RTNS-II) facility is the most intense continuous source of 14-MeV neutrons in the world. It is used to study the effects of fast neutrons on materials, to determine their suitability for use in fusion reactors. In RTNS-II, a water-cooled rotating target coated with titanium tritide is bombarded with deuterons. A small fraction of the incident deuterons fuse with the tritons in the target, producing 14.3-MeV neutrons. At present the neutron flux is substantially less than what a fusion test reactor would generate. This report examines the possibilities for upgrading RTNS targets to produce reactor-level neutron fluxes (or more). It is shown that the existing targets are operating near their thermal limit. However, modifications in target design and operating conditions are possible which could reasonably support up to a 30-fold increase in peak neutron flux ($\sim 3 \times 10^{14}$ neutrons/cm²-sec, or 6 MW/m²). The irradiated volume could also be increased, if desired. It seems likely that with some research and experimentation with palladium underlayers, target cladding/overcoating, and/or in-situ retritiding, an acceptable target lifetime can still be achieved at this greatly upgraded neutron flux. The proposed target modifications consist of a number of significant incremental improvements on the existing system, rather than one large breakthrough. Some of them could be implemented rapidly (time scale of less than a year); others would require somewhat more research (time scale of 2 or 3 years, depending on funding and staffing levels, and difficulties encountered). Each change can be independently omitted should technological difficulties arise. As such the overall RTNS upgrade process would be low-risk and high-payoff.

21569 **(UCID—20043) User's guide: fusion experiments analysis facility.** Carey, R.W.; Lerche, R.A. (Lawrence Livermore National Lab., CA (USA)). 20 Mar 1984. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008532.

The Fusion Experiments Analysis Facility (FEAF) is a computer facility based on a DEC VAX 11/780 computer. It became operational in late 1982. At that time two manuals were written to aid users and staff in their interactions with the facility. Because we've received a number of requests for copies of these manuals from other parts of the lab, we are making them available as UCID's. This guide is intended to provide new users with an introduction to the facility. It contains details about FEAF software, hardware, and operating procedures that are of interest to the general FEAF user. It is meant to supplement (not replace) the operating manuals supplied by software and hardware vendors.

21570 **(UCID—20044) Operating procedures: Fusion Experiments Analysis Facility.** Lerche, R.A.; Carey, R.W. (Lawrence Livermore National Lab., CA (USA)). 20 Mar 1984. Contract W-7405-ENG-48. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009661.

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The Fusion Experiments Analysis Facility (FEAF) is a computer facility based on a DEC VAX 11/780 computer. It became operational in late 1982. At that time two manuals were written to aid users and staff in their interactions with the facility. This manual is designed as a reference to assist the FEAF staff in carrying out their responsibilities. It is meant to supplement equipment and software manuals supplied by the vendors. Also this manual provides the FEAF staff with a set of consistent, written guidelines for the daily operation of the facility.

21571 **(UCID—20048) Effects of low-temperature fusion neutron irradiation on critical properties of a monofilament niobium-tin superconductor.** Guinan, M.W.; Van Konynenburg, R.A.; Mitchell, J.B. (Lawrence Livermore National Lab., CA (USA)). 22 Mar 1984. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008531.

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The objective of this work was to irradiate a Nb_3Sn superconductor with 14.8 MeV neutrons at 4 K and measure critical current in transverse fields of up to 12 T, irradiating up to a fluence sufficient to decrease the critical current to below its initial value. Critical temperatures were also to be measured. The samples were to be kept near 4 K between the irradiation and the measurement of critical properties. This work is directed toward establishing an engineering design fluence limit for Nb_3Sn when used in fusion reactor superconducting magnets.

21572 **(UCRL—50051-83-2) Mirror fusion quarterly report, April-June 1983.** Harrison, M.A.; Bobb, D. (eds.). (Lawrence Livermore National Lab., CA (USA)). 31 Dec 1983. Contract W-7405-ENG-48. 48p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008820.

Summaries of research during this period are given for the following: (1) Mirror Fusion Test Facility; (2) Tandem Mirror Experiment-Upgrade; (2) Fusion Plasma Theory and Computation, and (4) Fusion Reactor Materials. (MOW)

21573 **(UCRL—88213) Disassembly of isochorically heated liquids.** Blink, J.A.; Hoover, W.G. (Lawrence Livermore National Lab., CA (USA); California Univ., Davis (USA). Dept. of Applied Science). 1 Mar 1984. Contract W-7405-ENG-48. 28p. (CONF-840411—17). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009536.

From 3. meeting on liquid metal in energy applications; Oxford, UK (9 Apr 1984).

Sudden deposition of neutron energy into liquid metals with free surfaces is a common feature of many inertial confinement fusion (ICF) reactors. Since the energy is deposited in a time shorter than the liquid's sound transit time, there is no immediate volume change, and the pressure rises to levels that can cause the liquid metals to break into fragments. The degree of fragmentation determines the surface area available for cooling and condensation of liquid metal that was previously vaporized by the fusion target debis and x-rays. Hence, the fragmentation process could be essential to timely reduction of the chamber pressure to driver beam propagation levels.

21574 **(UCRL—89119) Ultrafast gated intensifier design for laser fusion x-ray framing applications.** Price, R.H.; Wiedwald, J.D.; Kalibjian, R.; Thomas, S.W.; Cook, W.M. (Lawrence Livermore National Lab., CA (USA)). 1 Nov 1983. Contract W-7405-ENG-48. 21p. (CONF-831015—42). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007761.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A major challenge for laser fusion is the study of the symmetry and the hydrodynamic stability of imploding fuel capsules. Streaked x-radiography, in one space and one time dimension, does not provide sufficient information. Two (spatial) dimensional frames of 10 to 100 ps duration are required with good image quality, minimum geometrical distortion (approximately 1%), dynamic range greater than 1000 and greater than 200 x 200 pixels. A gated transmission line imager (TLI) can meet these requirements with frame times between 30 and 100 ps. An instrument of this type is now being developed. Progress on this instrument including theory of operation, ultrafast pulse generation and propagation, component

integration, and high resolution phosphor screen development are presented.

21575 **(UCRL—89230) Technician support for operation and maintenance of large fusion experiments: the tandem mirror experiment upgrade (TMX-U) approach.** Mattson, G.E. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1983. Contract W-7405-ENG-48. 3p. (CONF-831203—132). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009087.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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As experiments continue to grow in size and complexity, a few technicians will no longer be able to maintain and operate the complete experiment. Specialization is becoming the norm. Subsystems are becoming very large and complex, requiring a great deal of experience and training for technicians to become qualified maintenance/operation personnel. Formal in-house and off-site programs supplement on-the-job training to fulfill the qualification criteria. This paper presents the Tandem Mirror Experiment-Upgrade (TMX-U) approach to manpower staffing, some problems encountered, possible improvements, and safety considerations for the successful operation of a large experimental facility.

21576 **(UCRL—89240) Ion cyclotron radio frequency systems and performance on the tandem mirror experiment-upgrade (TMX-U).** Moore, T.L.; Molvik, A.W.; Cummins, W.F.; Pedrotti, L.R.; Henderson, A.L.; Karsner, P.G.; Scofield, D.W.; Brooksby, C.A. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1983. Contract W-7405-ENG-48. 5p. (CONF-831203—129). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009108.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

High power ion cyclotron radio frequency (ICRF) systems are now gaining greater attention than before as prime driver ion heating systems. Lawrence Livermore National Laboratory (LLNL) has installed a 200 kW high frequency (HF) transmitter system on its Tandem Mirror Experiment-Upgrade (TMX-U). This paper describes the system, antenna, controls, and monitoring apparatus. The transmitter operates into a high Q antenna installed in the central cell region of the experiment. It incorporates a dual-port feedback system to automatically adjust the transmitter's output power and allow the maximum consistent with the plasma loading of the antenna. Special techniques have been used to measure, in real-time, the dynamically changing loading values presented by the plasma. From the measurements, the antenna impedance can be optimized for specified plasma density.

21577 **(UCRL—89241) Fundamental mode rectangular waveguide system for electron-cyclotron resonant heating (ECRH) for tandem mirror experiment-upgrade (TMX-U).** Rubert, R.R.; Felker, B.; Stallard, B.W.; Williams, C.W. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1983. Contract W-7405-ENG-48. 5p. (CONF-831203—131). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009085.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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We present a brief history of TMX-U's electron cyclotron resonant heating (ECRH) progress. We emphasize the 2-year performance of the system, which is composed of four 200-kW pulsed gyrotrons operated at 28 GHz. This system uses WR42 waveguide inside the vacuum vessel, and includes barrier windows, twists, elbows, and antennas, as well as custom-formed waveguides. Outside the TMX-U vessel are directional couplers, detectors, elbows, and waveguide bends in WR42 rectangular waveguide. An arc detector, mode filter, eight-arm mode converter, and water load in the 2.5-in. circular waveguide are attached directly to the gyrotron. Other specific areas discussed include the operational performance of the TMX-U pulsed gyrotrons, windows and component arcing, alignment, mode generation, and extreme temperature variations. Solutions for a number of these problems are described.

21578 **(UCRL—89242) Microwave measurement test results of circular waveguide components for electron cyclotron resonant heating (ECRH) of the Tandem Mirror Experiment-Upgrade (TMX-U).** Williams, C.W.; Rubert, R.R.; Coffield, F.E.; Felker, B.; Stallard, B.W.; Taska, J. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1983. Contract W-7405-ENG-48. 7p. (CONF-831203—134). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009538.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Development of high-power components for electron cyclotron resonant heating (ECRH) applications requires extensive testing. In this paper we describe the high-power testing of various circular waveguide components designed for application on the Tandem Mirror Experiment-Upgrade (TMX-U). These include a 2.5-in. vacuum valve, polarizing reflectors, directional couplers, mode converters, and flexible waveguides. All of these components were tested to 200 kW power level with 40-ms pulses. Cold tests were used to determine field distribution. The techniques used in these tests are illustrated. The new high-power test facility at Lawrence Livermore National Laboratory (LLNL) is described and test procedures are discussed. We discuss the following test results: efficiency at high power of mode converters, comparison of high power vs low power for waveguide components, and full power tests of the waveguide system. We also explain the reasons behind selection of these systems for use on TMX-U.

21579 **(UCRL—89245) Computer control of the titanium getter system on the tandem mirror experiment-upgrade (TMX-U).** McAlice, A.J.; Bork, R.G.; Clower, C.A.; Moore, T.L.; Lang, D.D.; Pico, R.E. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1983. Contract W-7405-ENG-48. 4p. (CONF-831203—133). NTIS, PC A02; 3; GPO Dep. Order Number DE84009086.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Gettering has been a standard technique for achieving high-quality vacuum in fusion experiments for some time. On Lawrence Livermore National Laboratory's Tandem Mirror Experiment (TMX-U), an extensive gettering system is utilized with liquid-nitrogen-cooled panels to provide the fast pumping during each physics experiment. The getter wires are a 85% titanium and 15% tantalum alloy directly heated by an electrical current. TMX-U has 162 getter power-supply channels; each channel supplies approximately 106 A of regulated power to each getter for a 60-s cycle. In the vacuum vessel, the getter wires are organized into poles or arrays. On each pole there are six getter wires, each cables to the exterior of the vessel. This arrangement allows the power supplies to be switched from getter wire to getter wire as the individual wires deteriorate after 200 to 300 gettering cycles. To control the getter power suppiles, we will install a computer system to operate the system and document the performance of each getter circuit. This computer system will control the 162 power supplies via a Computer Automated Measurement and Control (CAMAC) architecture with a fiber-optic serial highway. Getter wire history will be stored on the built-in 10 megabyte disc drive with new entries backed up daily on a floppy disc. Overall, this system will allow positive tracking of getter wire condition, document the total gettering performance, and predict getter maintenance/changeover cycles. How we will employ the computer system to enhance the getter system is the subject of this paper.

21580 **(UCRL—89274) High performance, suppressed-fission ICF hybrid.** Meier, W.R. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1983. Contract W-7405-ENG-48. 28p. (CONF-831203—116). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008298.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The neutronics aspects of an ICF hybrid concept are discussed. The breeding blanket consists of a beryllium neutron multiplier, metallic thorium fertile fuel and a liquid-lithium coolant. The fertile fuel fraction is 30 vol%, which is much higher than previous

one-zone, suppressed-fission hybrid concepts. Fission in the bred ^{233}U is suppressed by competition from tritium breeding reactions in ^{6}Li. The total breeding ratio, T + F, is 2.05, and the total neutron energy deposited is 41.1 MeV per DT neutron. The 800-MW (fusion) hybrid produces ~ 3500 kg of ^{233}U per full-power-year.

21581 **(UCRL—89291) Tritium control and activation in the Pulse*Star reactor.** Blink, J.A.; Hoffman, N.J. (Lawrence Livermore National Lab., CA (USA); Rockwell International Corp., Canoga Park, CA (USA). Energy Technology Engineering Center). 1 Dec 1983. Contract W-7405-ENG-48. 32p. (CONF-831203—118). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008059.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Pulse*Star is an inertial fusion reactor that uses LiPb coolant in a pool type geometry. LiPb does not release great quantities of chemical energy in a fire, and the pool geometry reduces the difficulty of safely transporting the extremely dense fluid. The compact geometry and good neutronics qualities of LiPb lead to a thermal-to-fusion energy ratio of 1.26, a tritium breeding ratio of 1.22, and a net electric power density 29 times higher than in a fission reactor containment building. The afterheat of the coolant and steel is low enough that emergency cooling systems will be either simple or not required. The gamma dose rate of the bell jar or screen is high enough to require remote maintenance of these components. The steam generators and pumps are on the borderline between limited hands-on and remote maintenance. With additional design attention, limited hands-on maintenance could be feasible for these components. The biological hazard potential indicates that only 10^{-7} to 10^{-6} of the reactor central region can be vaporized and released; these are values typical of other fusion reactor designs.

21582 **(UCRL—89569) High image quality sub 100 picosecond gated framing camera development.** Price, R.H.; Wiedwald, J.D. (Lawrence Livermore National Lab., CA (USA)). 17 Nov 1983. Contract W-7405-ENG-48. 10p. (CONF-831195—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008326.

From International congress on applications of lasers and electro-optics; Los Angeles, CA, USA (14 Nov 1983).

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A major challenge for laser fusion is the study of the symmetry and hydrodynamic stability of imploding fuel capsules. Framed x-radiographs of 10-100 ps duration, excellent image quality, minimum geometrical distortion (< 1%), dynamic range greater than 1000, and more than 200 x 200 pixels are required for this application. Recent progress on a gated proximity focused intensifier which meets these requirements is presented.

21583 **(UCRL—89868) Line intensities for diagnosing laser-produced plasmas.** Kauffman, R.L.; Matthews, D.L.; Lee, R.W.; Whitten, B.L.; Kilkenny, J.D. (Lawrence Livermore National Lab., CA (USA); Imperial Coll. of Science and Technology, London (UK)). 31 Oct 1983. Contract W-7405-ENG-48. 24p. (CONF-8310178—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009857.

From 2. international conference and workshop on radiative properties of hot dense matter; Sarasota, FL, USA (31 Oct 1983).

We have measured relative line intensities of the K x-ray spectra of Si, Cl, and Ca from laser-produced plasmas to assess their usefulness as a plasma diagnostic. The different elements are added at low concentrations to CH disks which are irradiated at 5 x 10^{14} W/cm^2 with a 0.53 μm laser pulse of 20 Joules at 1 nsec. The concentration of each element is kept low in order not to change the Z of the plasma, and therefore the plasma dynamics. The various spectra are measured with a time-resolved spectrograph to obtain line intensities as a function of time over the length of the laser pulse. These relative intensities of various He-like and H-like lines are compared with calculations from a steady-state level population code. The results give good consistency among the various line ratios. Agreement is not as good for analysis of the Li-like satellite lines. Modelling of the Li-like lines need further investigation. 10 references, 9 figures.

21584 (UTNL-R—0110, pp 11-15) **^{3}H research in the University of Tokyo facilities, (2). Catalytic oxidation of tritium in the air.** Tanaka, Satoshi (Tokyo Univ. (Japan). Faculty of Engineering). 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01.

In Summaries of environmental safety in nuclear fuel cycles; fiscal 1979 and 1980.

In nuclear fusion reactors and tritium facilities, as the method to remove tritium gas (T_2, HT, DT), the catalytic oxidation into steam (T_2O, HTO, DTO) and subsequent drying with an adsorbent are promising. The experiments made on the phase of the catalytic oxidation of tritium gas are described with some discussion. HT gas, and H_2 at the same time, are generated by the electrolysis of tritiated water. When the concentration in a tank has reached a certain level, the air containing tritium is allowed to flow into a system for investigating the oxidation characteristic of a catalyst. Downstream of this oxidation tower, there is a drying tower of molecular sieve. In both cases of 20% palladium asbestos and copper oxide, the relation between the unreacted fraction and the reciprocal of flow rate is linear. In the case of copper oxide, when the inlet concentration of H_2 or HT was varied, the reaction velocity constant is dependent on H_2 concentration but independent on HT concentration.

21585 **Electromagnetic particle simulations of self-magnetic-field-enhanced ion diodes.** Seidel, D.B.; Olsen, J.N.; Rosenthal, S.E. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **55**: No. 5, 1267-1273(1 Mar 1984). Contract AC04-76DP00789.

Electromagnetic particle simulations of equatorial self-magnetic-field-enhanced ion diodes have been performed. These simulations complement recent experiments on the particle beam fusion accelerator using the pinch ion diode (pid) and the Obi diode. Those experiments are detailed in a companion paper. The simulations have provided useful information concerning the operation of the diode. This paper will describe many of the simulation findings in such areas as current and charge neutralization, virtual cathode formation, diode impedance, ion divergence, and electron temperatures. In addition, a model for ion efficiency has been obtained that is based upon the simulation results. This model is compared to various other efficiency models.

21586 **Thermal transport measurements in 1.05 μm laser irradiation of spherical targets.** Yaakobi, B.; Delettrez, J.; Goldman, L.M.; McCrory, R.L.; Marjoribanks, R.; Richardson, M.C.; Shvarts, D.; Skupsky, S.; Soures, J.M.; Verdon, C. (Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 14623). *Physics of Fluids;* **27**: No. 2, 516-526(Feb 1984). Contract AC08-80DP40124.

Transport and implosion experiments have been conducted on the OMEGA 24-beam, uniform-irradiation facility. Thermal transport in spherical irradiation was found to be different than in comparable, single-beam target irradiation and could not be described in terms of a flux-inhibited model. Deep energy deposition in spherical irradiation (by electrons on the tail of the thermal velocity distribution) was found to lead to a temperature profile which is not as steep as predicted by a flux-inhibited model. This apparently leads to more explosive implosion (i.e., higher core temperature) than predicted by using such a model.

21587 **Density gradients to reduce fluid instabilities in multishell inertial-confinement-fusion targets.** Mikaelian, K.O.; Lindl, J.D. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **29**: No. 1, 290-296(Jan 1984). Contract W-7405-ENG-48.

The growth of Rayleigh-Taylor instabilities in inertial-confinement-fusion targets can be reduced if smooth density gradients are introduced at the interfaces. Keeping the total mass fixed, we consider spreading a heavy shell either continuously or in a discrete number of subshells. We calculate the rate for the fastest growing mode as a function of the fraction of mass spread and find the minima for the cases of 4, 6, and 8 subshells. The rates are reduced by 1.4—1.6. If all the mass is spread continuously into an exponen-

tial profile, we find that the rates are reduced by approximately $\sqrt{2\pi}$ roughly-equal 2.5.

21588 **Blanket technology. Report on the workshop, Erice, Sicily, 6-10 June 1983.** Hancox, R. (Euratom/UKAEA Fusion Association, Abingdon (UK). Culham Lab.); Baker, C.C. (Argonne National Lab., IL (USA)). *Nuclear Fusion;* **23**: No. 11, 1507-1512(Nov 1983). (CONF-8306152—).

From Workshop on fusion blanket technology; Erice, Italy (6 Jun 1983).

This paper reports on the workshop on blanket technology held in Erice, Sicily, 6-10 June 1983. The following items were discussed: 1) blanket concepts, 2) INTOR test reactor, 3) tritium breeding analysis and experiments, 4) international programmes, 5) tritium recovery and release, 6) coolant-breeder interactions and corrosion, 7) discussion of criteria for blanket selection, 8) electromagnetic and thermal-hydraulic analysis.

21589 **Capillary discharge thermonuclear burner design.** McCorkle, R.A. (IBM Watson Research Center, Yorktown Heights, NY (USA)). *Nuclear Instruments and Methods in Physics Research;* **215**: No. 3, 463-466(1 Oct 1983).

With 30 refs.

Design considerations are presented for a capillary discharge thermonuclear burner with parameters near energy break-even.

21590 **Shielding of future neutral beam injectors.** Ruby, L.; De Seynes, X. (Lawrence Berkeley Laboratory University of California Berkeley, CA 94720). *Transactions of the American Nuclear Society;* **45**: 624-625(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

21591 **Fast-ion orbit effects during ion cyclotron range of frequency experiments on the Princeton Large Torus.** Kaita, R.; Goldston, R.J.; Beiersdorfer, P.; Herndon, D.L.; Hosea, J.; Hwang, D.Q.; Jobes, F.; Meyerhofer, D.D.; Wilson, J.R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **23**: No. 8, 1089-1092(Aug 1983).

Letter-to-the-editor.

The angular dependence of the flux of fast neutrals was measured in conjunction with ion cyclotron range of frequency experiments on the Princeton Large Torus. A regime was found where the energetic tail of the charge-exchange neutral flux was strongly anisotropic. Unexpectedly, however, the flux from co-going ions was peaked at an angle intermediate between perpendicular and parallel. This could be the consequence of a preferential filling of that class of banana orbits whose tips are located within the ion cyclotron resonance layer.

21592 **Role of radiation damage analysis in the fusion program.** Doran, D.G. (Hanford Engineering Development Lab., Richland, WA (USA)). *Journal of Nuclear Materials;* **117**: 1-3(Jul 1983). (CONF-821049—).

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

The objective of radiation damage analysis is the prediction of the performance of facility components exposed to a radiation environment. The US Magnetic Fusion Energy materials program includes an explicit damage analysis activity within the Damage Analysis and Fundamental Studies (DAFS) Program. Many of the papers in these Proceedings report work done directly or indirectly in support of the DAFS program. The emphasis of this program is on developing procedures, based on an understanding of damage mechanisms, for applying data obtained in diverse radiation environments to the prediction of component behavior in fusion devices. It is assumed that the Fusion Materials Irradiation Test Facility will be available in the late 1980s to test (and calibrate where necessary) correlation procedures to the high fluences expected in commercial reactors.

21593 **Analysis of cleavage fracture potential of martensitic stainless steel fusion structures. Pt. 1. Micromechanical models and material properties.** Odette, G.R.; Lucas, G.E. (California Univ., Santa Barbara (USA). Dept. of Chemical and Nuclear Engineering). *Journal of Nuclear Materials;* **117**: 264-275(Jul 1983). (CONF-821049—).

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

With 44 refs.

The major disadvantage of martensitic stainless steels for structural applications in fusion reactors is currently considered to be their potential for low temperature brittle cleavage fracture. This study attempts to review the current understanding of cleavage fracture in steels and the role of microstructure in dictating material resistance to this type of fracture. A parametric analysis of cleavage fracture in a surrogate steel, A533B, is made and the results are used in conjunction with general cleavage fracture theory to establish some potential guidelines for future research in developing the martensitic stainless steels.

21594 **Analysis of cleavage fracture potential of martensitic stainless steel fusion structures. Pt. 2. Fracture analysis procedures for flawed fusion structures.** Odette, G.R.; Lucas, G.E. (California Univ., Santa Barbara (USA). Dept. of Chemical and Nuclear Engineering). *Journal of Nuclear Materials;* **117**: 276-286(Jul 1983). (CONF-821049—).

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

The potential for brittle cleavage fracture is a major concern for martensitic stainless steels which are candidates for fusion reactor structural materials. This study attempts to identify for flawed fusion structures the pertinent fracture resistance or failure parameters and the relationships between these parameters and the basic materials properties which govern cleavage fracture. Several procedures for relating test data to failure prediction, including Charpy-V-notch transition temperature referencing and two-parameter interpolation procedures, are considered; and results are discussed with respect to possible research paths for martensitic stainless steel alloy development.

21595 **Laser-driven implosion experiments.** McCall, G.H. (Los Alamos National Lab., NM (USA)). *Plasma Physics;* **25**: No. 3, 237-285(Mar 1983).

A review of the experiments associated with laser-driven implosions is presented. These experiments include actual implosion experiments and experiments which simulate particular aspects of laser-driven implosions. Exploding pusher and isentropic implosion experiments are treated separately. Where possible a comparison of the data to analytic or computer simulation calculations is made. Exploding pusher analytic theory is shown to be qualitatively correct, and the analytic models of ablation are compared to experiment. Current isentropic experiments, however, appear to be dominated by hot electron effects. It is shown that most of the experiments which have been reported do not display a strong dependence on laser wavelength, and this result is predicted by theory. An analysis which is intended to display the effects of hot electron preheat does demonstrate a dependence of implosion data on wavelength. It is also shown that some topics, such as transport and implosion stability, require much more experimental and theoretical effort. The conclusion reached is that long wavelength lasers may require more than 10 MJ to ignite a target.

21596 **Response of an orthotropic cylindrical shell to sudden heating.** Ray, H. (Rutgers - the State Univ., New Brunswick, NJ (USA). Dept. of Mechanical and Aerospace Engineering). *Nuclear Engineering and Design;* **74**: No. 3, 309-316(Mar 1983).

The parametric resonance of thin elastic orthotropic cylindrical shells in plane strain to suddenly developed uniform temperature is investigated. The shells are fabricated from laminated fiber-reinforced composite materials. The short-term analysis identifies the excitation of particular unstable modes. The long-term analysis shows that initially unstable circumferential flexural modes exchange energy with the circular mode in a cyclic manner. If the flexural motion is excited, the resulting displacements and stresses are substantially larger than the initial membrane values. The ef-

fects of temperature applied as a step function, shell geometry, number of layers, and fiber orientation are shown.

21597 **Ceramics for fusion reactor applications.** Clinard, F.W. Jr.; Hurley, G.F.; Klaffky, R.W. (Los Alamos National Lab., NM (USA)). *Res Mechanica;* 8: No. 4, 207-234(1983).

Ceramics are required in fusion reactors to serve as neutral beam injector insulators, dielectrics for RF heating systems, the toroidal current break, and magnet and direct converter insulators. Ceramics may also be needed for low-Z first wall structures, armor, limiters or divertor collectors. The characteristically severe operating conditions for these materials can result in significant degradation of bulk physical properties. Irradiation-induced changes in density, mechanical strength, thermal and electrical conductivity, dielectric breakdown strength, loss tangent, and DC electrolytic behavior must especially be considered. This paper reviews radiation effects in a number of candidate ceramics, including Al_2O_3, $MgAl_2O_4$, Si_3N_4, MgO, sialon, and SiC, and discusses their potential for use in the above applications. Techniques are proposed for optimizing ceramic performance based on current understanding of radiation damage mechanisms, and areas are specified where further studies are critically needed.

21598 **Neutron multiplier thermal stresses in pure fusion and fusion-fission reactor blankets.** Kostoff, R.N. (Department of Energy, Washington, DC (USA). Office of Energy Research). *Res Mechanica;* 9: No. 1, 1-34(1983).

An algorithm was derived for computing cyclic thermal stresses in the cladding of flat plate (slab) neutron multipliers heated by fusion-produced neutrons and located in the blanket of a fusion reactor whose core operates at an arbitrary pulsing frequency. When the thermal time constant of the slab is large relative to the cycle length, the cladding thermal stresses are approximately the same for all of the five fusion core concepts examined and equal to the steady state value. As the slab thermal time constant is decreased by decreasing the thickness of the slab, the absolute values of the cladding thermal stresses decrease, but at substantially different rates for long- and short-pulse concepts. For small slab thermal time constants, the cladding thermal stresses of the long-pulse concepts are substantially smaller than those of the short-pulse concepts.

21599 **Nuclear fusion power.** Dinghee, D.A. (Pacific Northwest Lab., Richland, WA). pp 557-592 of Handbook of energy technology and economics. Meyers, R.A. New York, NY; John Wiley and Sons (1983). Contract AC06-65RL01830.

In this chapter, fusion is compared with other inexhaustible energy sources. Research is currently being conducted both within and outside the USA. The current confinement principles of thermonuclear reactions are reveiwed with the discussion of economics mainly focusing on the magnetic confinement concepts. Environmental, health and safety factors are of great concern to the public and measures are being taken to address them. The magnetic fusion program logic and the inertial fusion program logic are compared.

21600 **Beam and deposition stability in light ion fusion targets.** Swegle, J.A. (Sandia National Labs., Albuquerque, NM (USA)). *Comments on Plasma Physics and Controlled Fusion;* 7: No. 4, 141-153(Sep 1982).

A quantitative assessment of the plasma stability of beam-target and deposition instabilities in light ion fusion targets is presented. The emphasis is on electrostatic and electromagnetic streaming instabilities using an analysis based upon the simplifying assumptions that the beam is collisionless and charge and current neutralized while the background medium is homogeneous and infinite in extent. Also included is a discussion of a potentially unstable process involving ion range shortening as the target heats, as well as treatment of a fluid condensation instability. Although the importance of this last topic remains unresolved, all other interactions are found to be benign on the time scales appropriate to the problem.

21601 **Light-ion energy deposition and implications for inertial confinement targets.** Widner, M.M.; Mehlhorn, T.A.; Perry, F.C.; Burns, E.J.T.; Farnsworth, A.V. Jr. (Sandia National Labs., Albuquerque, NM (USA)). *Comments on Plasma Physics and Controlled Fusion;* 7: No. 2, 37-45(Mar 1982).

One of the attractive features of the light ion beam fusion approach is efficient, collisional energy deposition. Previously developed models have accurately predicted energy deposition in cold material; however, in high energy density targets of interest to inertial confinement fusion (ICF), important modifications must also be considered, such as free electron stopping in ionized material. These effects are discussed, practical scaling formulas derived, and recent experimental data described. The data are consistent with collisional deposition at moderate beam intensity.

21602 **Connection length in stellarator geometries.** Shohet, J.L.; Anderson, D.T. (Wisconsin Univ., Madison (USA). Torsatron/Stellarator Lab.). *Comments on Plasma Physics and Controlled Fusion;* 7: No. 3, 103-110(Feb 1982).

The curvature of a magnetic field line in a stellarator device varies from favorable to unfavorable over a short distance. As a result, the connection length in these devices is much smaller than in an axisymmetric configuration such as a tokamak. This implies improved ballooning mode stability and feasibility of operation at higher aspect ratio.

21603 **Structure and properties of rapidly solidified austenitic stainless steels for the fusion reactor environment.** Grant, N.J.; Megusar, J.; Arnberg, L. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). pp 1491-1496 of Proceedings of the fourth international conference on rapidly quenched metals, 2. Masumoto, Tsuyoshi; Suzuki, Kenji (eds.) (Tohoku Univ., Sendai (Japan). Research Inst. for Iron, Steel and Other Metals). Sendai, Japan; Japan Inst. of Metals (1982). (CONF-810851—).

From 4. international conference on rapidly quenched metals; Sendai, Japan (24 Aug 1981).

From the viewpoint of fusion reactor environment problems, austenitic stainless steel has been selected as prime candidate alloy (PCA) in the Path A approach. The results of the optimization of the structure and properties of Path A PCA alloy by rapid solidification technology are presented in this paper. The production of rapidly solidified (RS) alloys comprises the preparation of master alloys, rapid solidification by the twin roller quenching technique and the consolidation of rapidly solidified foils by hot extrusion. The Path A-1, A-2 and A-3 alloys were provided by Oak Ridge National Laboratory. The hot extrusion and thermomechanical treatment (TMT) were applied to the alloys. The microstructure was examined by transmission electron microscopy (TEM) and scanning transmission electron microscopy (STEM). The room temperature tests were performed with an Instron testing machine. The stress-rupture tests were performed in a loading train of Udimet 500. The results showed that the structure and properties of Path A PCA alloy for fusion reactor environment have been modified by rapid solidification and subsequent thermomechanical treatment.

21604 **Improved axisymmetric-cusp plugs for tandem mirror reactors.** Logan, B.G. (Lawrence Livermore National Lab., CA (USA)). *Comments on Plasma Physics and Controlled Fusion;* 6: No. 6, 199-207(Sep 1981).

A proposal to use of pairs of axisymmetric-cusp magnets to provide magnetohydrodynamic (MHD) stability for tandem-mirror-reactor end plugs is considered. Several problems in that design which have come to light are reviewed and a simplification of the cusp magnet configuration is proposed that circumvents these problems.

21605 **Laser-plasma coupling in reactor-size targets.** Kruer, W.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Comments on Plasma Physics and Controlled Fusion;* 6: No. 5, 167-175(Aug 1981).

Laser-plasma coupling processes which can be important in reactor-size targets are briefly reviewed. Simple estimates are presented for the intensity-wavelength regime in which collisional absorption is high and collective effects are minimized.

21606 **Fuel-temperature determination for ICF microspheres.** Henderson, D.B.; Giovanielli, D.V. (Los Alamos National Lab., NM (USA)). *Comments on Plasma Physics and Controlled Fusion;* **6**: No. 5, 161-165(Aug 1981).

The common heuristic expression for estimating thermonuclear burn in ICF microspheres far from bootstrap heating is often inverted to obtain peak temperatures from experimental data. It contains an ad hoc or fitted parameter and lacks parameters of obvious influence in actual systems. An alternative expression is presented which may be usefully inverted and does not suffer these defects.

21607 **Stabilized axisymmetric tandem-mirror plug and barrier using field reversal.** Shuy, G.W.; Lee, Y.C.; Kantrowitz, F. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). *Comments on Plasma Physics and Controlled Fusion;* **6**: No. 4, 155-159(Apr 1981).

An axisymmetric tandem-mirror plug and barrier, in which neither ions trapped in the plug nor the barrier see any region of bad curvature, is described. Effects of nulls in the magnetic field, levitation, guarded leads and shielding requirements are discussed.

21608 **Large-mirror-ratio axisymmetric mirrors stabilized by surface magnetic fields.** Wong, A.Y.; Ferron, J.; Dimonte, G.; Young, P.; Leikind, B. (California Univ., Los Angeles (USA). Dept. of Physics). *Comments on Plasma Physics and Controlled Fusion;* **6**: No. 4, 131-138(Apr 1981).

An axisymmetric mirror stabilized against MHD instabilities by surface magnetic fields is described. Its high mirror ratio and large central volume reduce the free-energy sources for kinetic instabilities - the loss-cone ion-velocity distribution and the density gradient. Significant increases in electron temperature and ion-confinement time are calculated. The implications for mirror-reactor designs are discussed.

21609 **Evaluation of a relativistic electron-ring system as a plasma target for buildup of compact-toroid configurations.** Condit, W.C. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Comments on Plasma Physics and Controlled Fusion;* **6**: No. 3, 119-129(Mar 1981).

A review of the idea of using plasma-loaded electron rings as buildup targets for future compact-toroid machines is presented. Present experiments at Cornell University and Nagoya University are analyzed, and the need for auxiliary heating to reach interesting temperatures is described. Considerations of the effect of two-stream instability, toroidal field and plasma containment are discussed. It is concluded that, although the electron-ring approach is considerably more complicated than the plasma-gun approach, it has enough advantages to warrant renewed attention. It is further concluded that the two-stream problem is the most critical issue and is sufficiently complicated to require experimental testing of the nonlinear effects of the instability. Presently, experiments operate successfully in a parameter range where the instability is expected and, if these results can be scaled along the instability boundary in nsub(e)-Tsub(e), compact-torus reactor startup will be possible.

21610 **Beam requirements for light-ion-driven inertial-confinement fusion.** Mosher, D.; Colombant, D.G. (Naval Research Lab., Washington, DC (USA)); Goldstein, S.A. (JAYCOR, Alexandria, VA (USA)). *Comments on Plasma Physics and Controlled Fusion;* **6**: No. 3, 101-108(Mar 1981).

Beam requirements for light-ion-driven inertial-confinement fusion are discussed.

21611 **High-current betatron.** Rostoker, N. (California Univ., Irvine (USA)). *Comments on Plasma Physics and Controlled Fusion;* **6**: No. 2, 91-100(Dec 1980).

In the conventional betatron the problems of electron injection, beam stability during acceleration and beam extraction have been solved. The electron current may be limited by the injection method. It is proposed that electrons be injected by the method of inductive charging, which involves a toroidal magnetic field in addition to the normal betatron fields. It should then be possible to increase the electron current by a factor of 10^4-10^6. The toroidal magnetic field helps with the negative-mass instability, but introduces resonant instabilities. It is also proposed that the toroidal magnetic field be reduced after acceleration, and that one of the resonant instabilities be used to extract the beam.

21612 **Time-dependent study of linear collective ion acceleration.** Sternlieb, A. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). pp 118 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

21613 **Characterization techniques for high quality ICF targets.** Weinstein, B.W.; Hendricks, C.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 121 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract W-7405-ENG-48.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

21614 **Application of intense relativistic electron beams to steady state tokamaks.** Bailey, V.; Benford, J.; Helava, H. (Physics International Co., San Leandro, CA (USA)). pp 123 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

21615 **Formation of a reversed-field plasma configuration with a rotating relativistic electron beam.** Sethian, J.D.; Gerber, K.A.; Spector, D.N.; Robson, A.E. (Naval Research Lab., Washington, DC (USA)). pp 125 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

21616 **Laser fusion experiments at KMSF.** Johnson, R.R.; Berger, R.L.; Campbell, P.M. (KMS Fusion, Inc., Ann Arbor, MI (USA)). pp 131 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract AC08-78DP40030.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

21617 **Recent high density inertial fusion results from the Shiva facility.** Storm, E.K.; Ahlstrom, H.G.; Glaze, J.A.; Manes, K.R.; Nuckolls, J.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 136 of 9. European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

99 GENERAL AND MISCELLANEOUS

9901 Management

21618 (ABCC—1-63-Rev.) Publications manual: procedures and style. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Apr 1968. Contract AC01-76EV03081. 50p. (In Japanese and English). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008147.

This document is a style guide prepared to assist authors in present Atomic Bomb Casualty Commission (ABCC) scientific information of all types. Nontechnical presentations are discussed, but primary attention is directed toward the form and procedures for scientific reports.

21619 (ABCC—19-59) ABCC publication manual. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 1959. Contract AC01-76EV03081. 38p. (In Japanese and English). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008090.

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The reporting policy of the Atomic Bomb Casualty Commission is described in detail in this manual. Specific topics covered are: research project register; research publication policy; USA publication procedures; Japan publication procedures, report preparation instructions; and a glossary of institutions terms, phrases, and symbols. 15 figures. (DMC)

21620 (DOE/MA—0139/1) Listing of awardee names: active and inactive awards as of March 2, 1984. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Directorate of Procurement and Assistance Management). 1984. 420p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84009897.

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The Procurement and Assistance Data System (PADS) includes an alphabetical listing of all acquisition and financial assistance awards (excluding purchase orders) with the Department of Energy. The entries consist of awardee name, BIN number, a 14 digit business instrument number of the legal document that constitutes the agreement, award date, completion date, retirement date, city, state, and contract value.

21621 (NUREG/BR—0072-Rev.1) EDO procedures manual. Revision 1. (Nuclear Regulatory Commission, Washington, DC (USA). Office of the Executive Director for Operations). Jan 1984. 155p. NTIS, PC A08/MF A01 - GPO. Order Number DE84900847.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 20036, 20040, 20644

21622 (ABCC-TR—22-68) Numerical comparison of improved methods of testing in contingency tables with small frequencies. Sugiura, Nariaki; Otake, Masanori. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). 14 Nov 1968. Contract AC01-76EV03081. 17p. (In Japanese and English). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008145.

The significance levels of various tests for a general c x k contingency table are usually given by large sample theory. But they are not accurate for the one having small frequencies. In this paper, a numerical evaluation was made to determine how good the approximation of significance level is for various improved tests that have been developed by Nass, Yoshimura, Gart, etc. for c x k contingency table with small frequencies in some of cells. For this purpose we compared the significance levels of the various approximate methods (i) with those of one-sided tail defined in terms of exact probabilities for given marginals in 2 x 2 table; (ii) with those of exact probabilities accumulated in the order of magnitude of Chi^2 statistic or likelihood ratio (=LR) statistic in 2 x 3 table mentioned by Yates. In 2 x 2 table it is well known that Yates' correction gives satisfactory result for small cell frequencies and the other methods that we have not referred here, can be considered if we devote our attention only to 2 x 2 or 2 x k table. But we are mainly interested in comparing the methods that are applicable to a general c x k table. It appears that such a comparison for the various improved methods in the same example has not been made explicitly, even though these tests are frequently used in biological and medical research. 9 references, 6 figures, 6 tables.

21623 (CONF-840270—1) Proposed text for logical attributes sections of ODA/ODIF and commentary thereon, together with selected examples. Mason, J.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007604.

From International Standards Organization meeting; Geneva, Switzerland (1 Feb 1984).

Unlike layout objects, logical objects need to be defined in a generic structure before they can be used in a specific structure. Furthermore, inheritence of properties of logic objects should come through the generic structure rather than through the specific structure. Appropriate values of attributes are suggested.

21624 (CONF-8405128—1) Portable environment for research in automated reasoning. Lusk, E.L.; Overbeek, R.A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009212.

From 7. annual conference on automated deduction - CADE 7; Napa, CA, USA (14 May 1984).

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The Interactive Theorem Prover (ITP), an environment that supports research into the theory and application of automated reasoning, is described. ITP is an interactive system providing convenient access to and control of the many inference mechanisms of Logic Machine Architecture (LMA), described elsewhere. LMA itself has been substantially enhanced since the last report on its status, and we describe here some of the enhancements, particularly the addition of a tightly-coupled logic programming component, which provides an integration of the theorem-proving and logic programming approaches to problems represented in the predicate calculus. 9 references.

21625 (DOE/ET/37873—1-Pt.1) Geometric modelling by computer and the implementation of TIPS-1. Tong, R. (Washington Univ., Seattle (USA). Dept. of Electrical Engineering). 1 Dec 1981. Contract AT06-80ET37873. 184p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84000904.

Portions are illegible in microfiche products; Thesis.

The purpose of this thesis is two-fold. The first task is to discuss the methodologies currently used in geometric modelling systems for the modelling of three dimensional solid objects. The concept of using computers to model objects is important in many scientific disciplines such as computer graphics, architecture and mechanical engineering that deal with spatial phenomena. Typically, computer models are used to create databases for design analysis, the generation of drawings and the control of manufacturing machines. Various issues involved and the alternative techniques used in the generation of computer models are discussed. A second purpose of this thesis is to implement a geometric modeller called TIPS-1 (Technical Information Processing System - 1) on a minicomputer. This serves to provide a facility for the learning and exercise of geometric modelling and computer-aided design principles. Some details of the implementation are presented. Sufficient document is also provided to facilitate system use, program maintenance and future expansion. 37 references, 71 figures, 1 table.

21626 (FXM—922-Suppl.1) Supplement and a correction to FXM 922: survey report on the reliability of systems. Riley, J.A. (Pratt and Whitney Aircraft, East Hartford, CT (USA)). 17 Nov 1954. Contract AC02-84PW02789. 3p. (TIM—75-Suppl.1). NTIS, PC A02; 3; GPO Dep. Order Number DE84007614.

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Formulae are given for the calculation of the reliability of equipments in series and in parallel, given the reliability of each equipment. Report FXM-922 must be available to understand some of the equations presented here. (LTW)

21627 **(GEPP-OP—754a) Success with Data Management IV at the DOE Pinellas Plant.** Denty, M.A. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 1983. Contract AC04-76DP00656. 13p. (CONF-8310260—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008021.

From Honeywell Large Systems Users Association forum XXXVII; San Diego, CA, USA (16 Oct 1983).

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A description is presented of the Data Management IV (DMIV) design and implementation approach used at the DOE Pinellas Plant (operated by the General Electric Neutron Devices Department) for two major on-line systems: one supporting Purchasing and General Stockroom; the other supporting engineering product configuration definition and engineering drawing distribution control. Subtopics include data base administration practices, transaction processing considerations, data base design techniques, as well as an overview of the applications themselves. Discussion outlines problems solved and pitfalls avoided.

21628 **(HEDL—7368) Series of 23 short computer programs for use on a GE Calma Company computer aided design system.** Gold, R.C.; Lutter, T.M.; Swannack, W.C. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1983. Contract AC06-70FF02170. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010258.

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An index of the codes and a very brief description of their functions are presented. (GHT)

21629 **(LA-UR—83-2885) Learning about supercomputers on a microcomputer with no keyboard: a science museum exhibit.** Stoddard, M.; Buzbee, B.L. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-840539—1). NTIS, PC A02/MF A01. Order Number DE84001177.

From 25. annual ADCIS conference; Columbus, OH, USA (14 May 1984).

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A microcomputer exhibit was developed to acquaint visitors of the Los Alamos National Laboratory's Bradbury Science Museum with supercomputers and computer-graphics applications. The exhibit is highly interactive, yet the visitor uses only the touch panel of the CD 110 microcomputer. The museum environment presented many constraints to the development team, yet the five minute exhibit has been extremely popular with visitors. Design details of how each constraint was dealt with to produce a motivating and instructional exhibit are provided. Although the program itself deals with a subject area primarily applicable to Los Alamos, the design features are transferrable to other courseware where motivational and learning aspects are of equal importance.

21630 **(LA-UR—84-470) ADP computer security classification program.** Augustson, S.J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-8404117—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007507.

From 7. DOE computer security conference; New Orleans, LA, USA (10 Apr 1984).

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CG-ADP-1, the Automatic Data Processing Security Classification Guide, provides for classification guidance (for security information) concerning the protection of Department of Energy (DOE) and DOE contractor Automatic Data Processing (ADP) systems which handle classified information. Within the DOE, ADP facilities that process classified information provide potentially lucrative targets for compromise. In conjunction with the security measures required by DOE regulations, necessary precautions must be taken to protect details of those ADP security measures which could aid in their own subversion. Accordingly, the basic principle underlying ADP security classification policy is to protect information which could be of significant assistance in gaining unauthorized access to classified information being processed at an ADP facility. Given this policy, classification topics and guidelines are approved for implementation. The basic program guide, CG-ADP-1 is broad in scope and based upon it, more detailed local guides are sometimes developed and approved for specific sites. Classification topics are provided for system features, system and security management, and passwords. Site-specific topics can be addressed in local guides if needed.

21631 **(LA-UR—84-1120) Computer graphics support service.** Dickman, D.O. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 13p. (CONF-8405131—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010001.

From 6. annual ideas in science and engineering exposition and symposium; Albuquerque, NM, USA (2 May 1984).

Computer graphics can be an integral part of a graphics support service. This presentation will discuss several types of computer graphics software and hardware and how computer graphics are integrated into a graphics support service. Various computer graphics software packages will be discussed, and several types of output will be presented. The terminals and cameras we use, such as a high-resolution color graphics terminal and a multi-image camera, will be discussed as will be the use of various types of film.

21632 **(LBL-PUB—3038) WC - user's guide.** Wald, S.; Countryman, P. (Lawrence Berkeley Lab., CA (USA); Stanford Univ., CA (USA). High-Energy Physics Lab.). Feb 1984. Contract AC03-76SF00098. 192p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84009242.

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WC is an interactive code for analyzing (or simulating) multiparameter experiments. It enables the user to perform complex manipulations of the data on an event-by-event basis, generate output tapes, and display results (as tables or graphs) in a variety of formats. Many powerful features can be invoked interactively, such as definition of one- and two-dimensional (free-form) gates, certain kinds of pseudo-parameters, spectrum definitions (gated or otherwise) and virtual displays (also gated). Still more complex operations can be done on an event-by-event basis by means of a subroutine which can be modified to the user's specifications and linked to the body of the program. Operations can be made with ease upon the accumulated spectra, including chi^2 fits of various functions to the one-dimensional spectra. The spectra produced and the fits can also be plotted.

21633 **(PB—83-217554) Overview of computer vision.** Gevarter, W.B. (National Bureau of Standards, Washington, DC (USA)). Sep 1982. 170p. (NBSIR—82-2582). NTIS, PC A08.

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This report provides an overview of computer vision. The emphasis is on image understanding and scene analysis, though pertinent aspects of pattern recognition are treated. Image processing for sensor correction, rectification, image enhancement, etc., is not covered. This report reviews the basic approach to computer vision systems, the techniques utilized, applications, the current existing systems and state-of-the-art, issues and research requirements, who is doing it and who is funding it, and finally future trends and expectations. The intent is to provide an overall perspective of this vital field with its many participants, that will be useful to engineering and research managers, potential users and others who will be affected by this field as it unfolds. 112 references, 10 tables.

21634 **(SAND—83-2431) Users manual: CAMPAGS, mass properties analysis program for VAX.** Blazek, D.R. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1984. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008526.

CAMPAGS is an interactive program that computes mass properties, including weight, area, center of gravity, moments, and products of inertia. The program runs on a VAX/VMS computer and interactively accepts geometry definitions of items to be ana-

lyzed. This report describes user interaction with the program options and gives examples of program use.

21635 **(UCID—18756-Rev.2) User's manual for DYNA2D: an explicit two-dimensional hydrodynamic finite element code with interactive rezoning.** Hallquist, J.O. (Lawrence Livermore National Lab., CA (USA)). Jul 1980. Contract W-7405-ENG-48. 119p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84010100.

This revised report provides an updated user's manual for DYNA2D, a vectorized, explicit, two-dimensional, axisymmetric and plane strain finite element code for analyzing the large deformation dynamic and hydrodynamic response of inelastic solids. A contact-impact algorithm permits gaps and sliding with friction along material interfaces. By a specialization of this algorithm, such interfaces can be rigidly tied to admit variable zoning without the need of transition regions. Spatial discretization is achieved by the use of 4-node solid elements, and the equations-of-motion are integrated by the central difference method. An interactive rezoner eliminates the need to terminate the calculation when the mesh becomes too distorted. Rather, the mesh can be rezoned and the calculation continued. The command structure for the rezoner is described and illustrated by an example.

21636 **(UCID—20035) NLTSS overview.** DuBois, P.J. (Lawrence Livermore National Lab., CA (USA)). 8 Nov 1983. Contract W-7405-ENG-48. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008536.

The LTSS operating system supports multi-programming, time-sharing, interactive computing, automated batch computing, limited interprocess communication, multiple independent simultaneously executing job streams for a single user (all streams accessible from the same terminal), and the ability for a process to create, load, and start another process. Such processes may subsequently communicate freely with each other. The interprocesses communication logic is most commonly used when independent job streams wish to communicate.

21637 **(UCID—30198) Requirements for migration of NSSD code systems from LTSS to NLTSS.** Pratt, M. (Lawrence Livermore National Lab., CA (USA)). 22 Feb 1984. Contract W-7405-ENG-48. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009533.

The purpose of this document is to address the requirements necessary for a successful conversion of the Nuclear Design (ND) application code systems to the NLTSS environment. The ND application code system community can be characterized as large-scale scientific computation carried out on supercomputers. NLTSS is a distributed operating system being developed at LLNL to replace the LTSS system currently in use. We begin by examining the implications of change, including a description of the computational environment and users in ND. The discussion then turns to requirements, first in a general way, followed by specific requirements, including a proposal for managing the transition.

21638 **(UCRL—78910) When you wish upon a star.** Hendrickson, C.P. (Lawrence Livermore National Lab., CA (USA)). Dec 1976. Contract W-7405-ENG-48. 9p. (CONF-770303—3). NTIS, PC A02/MF A01.

From Corrosion/77 NACE meeting; San Francisco, CA, USA (14 Mar 1977).

The experiences of a computer user are given for a three year period of interaction with the CDC STAR-100 computer. The paper describes the history of the CDC STAR acquisition in brief detail, and the transfer of a large computer code from the CDC 7600 to the STAR. The shortcomings of the STAR are discussed and some simple equations are derived which aid in finding an upper limit to the running speed of a transferred code.

21639 **(UCRL—89755) Special or general purpose end-to-end transport mechanisms in distributed systems: one view.** Watson, R.W.; Mamrak, S. (Lawrence Livermore National Lab., CA (USA); Ohio State Univ., Columbus (USA)). Feb 1984. Contract W-7405-ENG-48. 13p. (CONF-8405126—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008297.

From 4. international conference on distributed computing systems; San Francisco, CA, USA (14 May 1984).

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There is increasing interest in the design of special-purpose end-to-end transport mechanisms for use in distributed systems. This work is motivated by the perceived high delay, CPU, and other costs of many general-purpose transport protocol designs and implementations. The special-purpose designs try to minimize the mechanisms needed to match the error and other service properties of specific networks with the services required by application and communication interface semantics. The paper argues that general-purpose transport protocol designs and implementations can be effective in a wide range of distributed applications because: (1) many of the mechanisms and implementation techniques used in the special-purpose work apply to general-purpose transport protocol designs and implementations; (2) special-purpose designs have hidden costs; and (3) quite special overall system loads, application response times, and interaction patterns are required before general-purpose protocols are the main performance bottlenecks.

21640 **(UIUCDCS-R—84-1151) FRED user's manual.** Shilling, J. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Feb 1984. Contract AC02-76ER02383. 44p. (UILU-ENG—84-1706; COO—2383-0101). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010028.

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FRED, the friendly editor, is a screen-based structured editor. This manual is intended to serve the needs of a wide range of users of the FRED text editor. Most users will find it sufficient to read the introductory material in section 2, supplemented with the full command set description in section 3. Advanced users may wish to change the keystroke sequences which invoke editor commands. Section 4 describes how to change key bindings and how to define command macros. Some users may need to modify a language description or create an entirely new language description for use with FRED. Section 5 describes the format of the language descriptions used by the editor, and describes how to construct a language grammar. Section 6 describes known portability problems of the FRED editor and should concern only system installation personnel. The editor points out syntax errors in the file being edited and does automatic pretty printing.

9903 Information Handling

21641 **(UCRL—89704) Display units for online passage retrieval: a comparative analysis.** Girill, T.R. (Lawrence Livermore National Lab., CA (USA)). Sep 1983. Contract W-7405-ENG-48. 24p. (CONF-840560—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84001004.

From 31. international technical communication conference; Seattle, WA, USA (1 May 1984).

Several commercial and governmental computer services now let users retrieve passages online from the full text of books, statutes, or journal articles. The display units in which the test is packaged, however, vary greatly between systems, and these units heavily influence the quality of service. Four reader problems concerning printed books - finding where subjects are discussed, assessing how important each treatment is, linking scattered treatments of the same subject, and exploiting the test's organization - all have standard solutions involving widespread, time-tested indexing strategies. All four problems reappear in computerized passage-retrieval systems. But, in each case, structural display units (those based on format) prove much less successful than functional display units (based on content) in permitting the traditional solutions to work online too. hence, functional units consistently support better access to online information than do structural units.

9905 Civilian Defense

21642 **(AD-A—134608/9) Strategic implications of civil defense. Strategic issues research memo.** Weinstein, J.M. (Army War Coll., Carlisle Barracks, PA (USA). Strategic Studies Inst.). 5 May 1983. 50p. NTIS, PC A03/MF A01.

This memorandum explores the relationship between civil defense, national vulnerabilities and the deterrence of nuclear war-

fare between the Soviet Union and the United States. The author examines the problems and effectiveness of the major elements of Soviet civil defenses (leadership and population protection; industrial protection; and postattack recovery) to determine whether, and to what extent, the Soviet capabilities undermine crisis stability and deterrence. The proposals of the Carter (PD-41) and Reagan (NSDD-26) administrations to strengthen deterrence and to reduce national destruction should deterrence fail are evaluated to determine whether the United States should augment and modernize its civil defenses. Americans will evacuate high risk areas in the event of a crisis, and it remains the responsibility of government to minimize the chaos and moderate the effects with some prior planning. The costs of such plans, relative to competing strategic military systems and programs, are rather modest. The author is skeptical, however, about the utility and cost-effectiveness of the extensive blast shelter program advocated by some civil defense proponents in the United States.

21643 **(ORNL—6029) Application of the radiological defense capabilities to peacetime radiological incidents. Final report.** Gant, K.S.; Adler, M.V. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 42p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009451.

This paper discusses the applicability of the nuclear attack components of the radiological defense (RADEF) system, including organizational structures, training, instrumentation, and subsystem capabilities, to peacetime incidents and proposes some actions for addressing all hazards with the RADEF system. Many of the components of RADEF are applicable to peacetime response, but modifications are needed in planning, training, equipment, and titles. Development of the nuclear attack components should be encouraged in all states, but the peacetime response must be more flexible to accommodate the variety of state requirements and organizations. It is suggested that modular training courses be developed to include peacetime radiological response; the modular design will enable the courses to be easily updated. Additional, more flexible, radiation detection equipment would enhance the peacetime usefulness of RADEF (and probably increase the level of training required); the current instrumentation is designed primarily for the high gamma radiation fields expected in a postattack environment. The FEMA-supplied GM survey meter intended for training purposes is being used in emergency response, but many of those using the meter are not aware of its limitations. No major disadvantages are seen to a comprehensive program; the standards for such a program will have to insure that the attack-preparedness aspects of the program receive sufficient attention. Advantages would include improvement in the stature and quality of the RADEF personnel; recruitment of new monitors and volunteers through the interest in peacetime response; increased readiness due to more frequent drills, exercises, and responses to emergency situations; and better communication and coordination with the other radiation protection professionals within the state. 7 references, 3 tables.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

A

Abilene Christian Univ., TX (USA)
Precision measurements of pion nucleon elastic scattering in the P3 energy region at LAMPF. 1984 progress report, 9:21214 (R;US)

Adcock (Larry) and Associates, Albuquerque, NM (USA)
Sociocultural analysis for the proposed Waste Isolation Pilot Plant, 9:19829 (R;US)

Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.
Acceleration and confinement of energetic particles in the 7 June 1980 solar flare. Technical report, 9:21160 (R;US)

AG Associates, Palo Alto, CA (USA)
Heatpulse annealing of ion-implanted silicon: structural characterization by transmission electron microscopy, 9:20516 (R;US)

AIA Research Corp., Washington, DC (USA)
Phase two report for the development of energy performance standards for new buildings. Task report: mobile homes, 9:20367 (R;US)
Phase two report for the development of energy performance standards for new buildings. Task report: single-family dwellings, 9:20368 (R;US)
Phase two report for the development of energy performance standards for new buildings. Appendix D. Energy conscious designs, 9:20369 (R;US)
Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings, 9:20370 (R;US)

AiResearch Mfg. Co., Torrance, CA (USA)
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Qualifier
Title, (supplementary information), citation number, (R:US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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AC01-82CE15151	**Cardinal Management Associates, Inc., Los Angeles, CA (USA)**	
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AC01-82ER30042	**Southern Science, Dunedin, FL (USA)**	
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AC01-83CE23861	**Institute for Human Development, Philadelphia, PA (USA)**	
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	9:20640	FERMILAB/TM—1238
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AC02-79ET34019	Toledo Edison Co., OH (USA)	
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AC02-82ER53136	Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy	
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AC05-82OR20900	Oak Ridge Gaseous Diffusion Plant, Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee	
	9:19725	Nuclear Technology 62 NO. 3. 325-334 (Sep 1983).
AC05-84OR21400	Oak Ridge National Lab., TN (USA)	
	9:19626	ORNL—5782
	9:19823	ORNL/TM—8991
	Fluor Engineers and Constructors, Inc., Houston, TX (USA)	
	9:19886	ORNL/Sub—81/24707/2
	Oak Ridge National Lab., TN (USA)	
	9:20035	ORNL-tr—5086(1984).
	General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center	
	9:20353	DOE/OR/21400—T2
	Oak Ridge National Lab., TN (USA)	
	9:20391	ORNL/CON—149
	9:20454	ORNL/FMP—84/1
	General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center	
	9:20587	ORNL/Sub—81/70519/1
	Oak Ridge National Lab., TN (USA)	
	9:20724	DOE/NBB—0053
	9:21482	ORNL/TM—9034
	9:21643	ORNL—6029
AC05-84OS21400	Oak Ridge Y-12 Plant, TN (USA)	
	9:20593	Y/LA—810-Rev.1

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	Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)	
	9:20594	Y/Sub—80-7733/201
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
	9:20606	K-L—6215
AC06-65RL01830	**Pennsylvania State Univ., University Park (USA). Materials Research Lab.**	
	9:19739	BMI/ONWI—523
	Pacific Northwest Lab., Richland, WA (USA)	
	9:19778	DOE/UMT—0214
	9:19783	PNL—3594-Rev.4
	9:19784	PNL—4945
	9:19794	Nuclear Technology 63 NO. 1. 82-89 (Oct 1983).
	9:19820	NUREG/CR—3104
	9:19822	NUREG/CR—3560
	9:19887	PNL-SA—11878
	9:19964	PNL—5042
	9:20016	NUREG/CR—3561
	9:20161	NUREG/CR—3621
	9:20412	PNL—4850
	9:20413	PNL—4852
	9:20414	PNL—4855
	9:20415	PNL—4910
	Energetics, Inc., Columbia, MD (USA)	
	9:20416	PNL—5061
	Pacific Northwest Lab., Richland, WA (USA)	
	9:20677	PNL-SA—11890
	9:20753	PNL—5035
	9:21116	PNL-SA—10247
	9:21203	Physical Review [Section] A: General Physics 29 NO. 1. 70-76 (Jan 1984).
AC06-70FF02170	**Pacific Northwest Lab., Richland, WA (USA)**	
	9:19727	HEDL-SA—2892-FP
	Hanford Engineering Development Lab., Richland, WA (USA)	
	9:20150	HEDL-SA—2841
	9:20482	Journal of Nuclear Materials 117 46-54 (Jul 1983).
	9:20496	HEDL—7372
	9:21099	HEDL—7365
	9:21550	HEDL—7436
	9:21628	HEDL—7368
AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
	9:21551	HEDL—7437
AC06-77DP40037	**Mathematical Sciences Northwest, Inc., Bellevue, Washington 98004**	
	9:20459	Journal of Applied Physics 55 NO. 7. 2721-2725 (1 Apr 1984).
AC06-80RL01030	**Atlantic Richfield Hanford Co., Richland, WA (USA). Separations Chemistry Lab.**	
	9:19738	ARH-SA—49
	Arizona State Univ., Tempe (USA)	
	9:19785	RHO-BW-SA—302AP
AC07-76ET10723	**Associated Western Universities, Inc., Salt Lake City, UT (USA)**	
	9:19648	DOE/ET/10723—1545
AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
	9:19742	CONF-8308106—
	9:20079	EGG-M—12583
	9:20080	EGG-M—14083
	9:20146	EGG—2303
	9:21544	EGG-M—10783
AC07-82CE40558	**Manville Service Corp., Denver, CO (USA). Research and Development Center**	
	9:20400	DOE/CE/40558—T1
AC07-84ID12435	**Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)**	
	9:19792	WINCO—1001
AC08-76NV00410	**EG and G Idaho, Inc., Idaho Falls (USA)**	
	9:19760	CONF-8308106—(1983).

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AC08-76NV01183	**EG and G, Inc., Goleta, CA (USA**	
	9:20689	Nuclear Instruments and Methods in Physics Research 213 NO. 1. 95-101 (15 Jul 1983).
AC08-76NV01183	**EG and G, Inc., Goleta, CA (USA**	
	9:20690	Nuclear Instruments and Methods in Physics Research 213 NO. 1. 103-105 (15 Jul 1983).
AC08-76NV01183	**EG and G, Inc., Goleta, CA (USA**	
	9:20691	Nuclear Instruments and Methods in Physics Research 213 NO. 1. 107-113 (15 Jul 1983).
AC08-76NV01183	**University of Southern California, Marina Del Rey (USA**	
	9:20692	Nuclear Instruments and Methods in Physics Research 213 NO. 1. 115-122 (15 Jul 1983).
AC08-76NV01183	**Colorado Univ., Boulder (USA**	
	9:20694	Nuclear Instruments and Methods in Physics Research 213 NO. 1. 127-132 (15 Jul 1983).
AC08-80DP40124	**Rochester Univ., NY (USA). Lab. for Laser Energetics**	
	9:20598	DOE/DP/40124—21
	9:21586	Physics of Fluids 27 NO. 2. 516-526 (Feb 1984).
AC08-81NV10162	**Nevada Univ., Las Vegas (USA). Desert Research Inst.**	
	9:20761	DOE/NV/10162—14
AC08-83NV10282	**EG and G, Inc., Las Vegas, NV (USA)**	
	9:19776	DOE/NV/10282—T4
	9:19777	DOE/NV/10282—T5
	EG and G, Inc., Goleta, CA (USA). Energy Measurements Group	
	9:20626	EGG—10282-2012
	EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.	
	9:20762	EGG—10282-1001
	9:20763	EGG—10282-1026
AC08-84NV10327	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)**	
	9:20145	DOE/NV/10327—5
AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
	9:19827	DP-MS—84-16
	9:19857	DP-MS—83-85
	9:19858	DPST—80-129-6
	9:19859	DPST—81-133-1
	9:19860	DPST—82-133-1
	9:19861	DPST—83-133-1
	9:20041	DP—1670
	9:20731	DP—1675
	9:20864	DP-MS—83-102
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
	9:21098	DP-MS—84-29
AC09-76SR00819	**Savannah River Ecology Lab., Aiken, SC (USA)**	
	9:20866	SREL—15
AC19-79BC10116	**Minnesota Univ., Minneapolis (USA). Inst. of Tech.**	
	9:19670	DOE/BC/10116—26
AC19-80BC10188	**Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.**	
	9:19630	DOE/BC/10188—33
AC19-81BC10349	**Walk-Haydel and Associates, Inc., New Orleans, LA (USA)**	
	9:19674	DOE/BC/10349—1
AC21-80MC14591	**General Electric Corp. Research and Development Center, Box 8, Schenectady, NY 12301**	
	9:19627	CHEMTECH 13 NO. 10. 624-629 (Oct 1983).

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AC21-80MC14603	Conspray Construction Systems, Inc., Santa Ana, CA (USA)	
	9:19659	DOE/MC/14603—1562
AC21-81MC16015	New Mexico Univ., Albuquerque (USA). Dept. of Chemical and Nuclear Engineering	
	9:19690	DOE/MC/16015—1368-Vol.2
AC21-81MC16049	Flow Industries, Inc., Kent, WA (USA). Research and Technology Div.	
	9:19982	DOE/MC/16049—1558-Vol.1
	9:19983	DOE/MC/16049—1558-Vol.2
AC21-81MC16359	Pennsylvania State Univ., University Park (USA)	
	9:19637	DOE/MC/16359—1521
AC21-81MC16518	Brigham Young Univ., Provo, UT (USA). Combustion Lab.	
	9:19610	DOE/MC/16518—1476
AC21-82MC19077	Pacific Northwest Lab., Richland, WA (USA)	
	9:19611	DOE/MC/19077—1532
AC21-82MC19239	Lewin and Associates, Inc., Washington, DC (USA)	
	9:19693	DOE/MC/19239—1546
AC21-82MC19299	Lockheed Missiles and Space Co., Inc., Sunnyvale, CA (USA). Energy Systems	
	9:19660	DOE/MC/19299—1564
AC21-82MC19404	United States Steel Corp., Monroeville, PA	
	9:19654	DOE/MC/19404—T14
AC21-83MC20315	General Electric Co., Schenectady, NY (USA). Gas Turbine Div.	
	9:20617	CONF-840302—3
AC22-80ET15611	Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.	
	9:20350	DOE/ET/15611—15
AC22-83PC60015	Wyoming Univ., Laramie (USA)	
	9:20540	DOE/PC/60015—9
AC22-83PC60266	Florida State Univ., Tallahassee (USA). Dept. of Physics	
	9:19641	DOE/PC/60266—T2
AC75-82SW13008	North Texas State Univ., Denton (USA). Dept. of Biological Sciences	
	9:19896	DOE/SW/13008—T1
AC79-80BP17530	Oregon State Univ., Corvallis (USA). Dept. of Atmospheric Science	
	9:19966	DOE/BP—195
AC97-80ET46617	Bureau of Economic Geology, The Univ. of Texas at Austin, Austin, TX	
	9:19668	AAPG Bulletin 67 NO. 8. 1219-1244 (Aug 1983).
	9:19669	AAPG Bulletin 67 NO. 8. 1245-1274 (Aug 1983).
AI01-76CS20002	Army Natick Research and Development Command, MA (USA). Science and Advanced Technology Lab.	
	9:19882	DOE/CS/20002—T1
AI01-77ET20342	Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.	
	9:19930	JHU/APL-AEO—81-122
	9:19931	JHU/APL-OQR—82-1
	9:19932	JHU/APL-OQR—82-2
	9:19933	JHU/APL-OQR—82-3
	9:19934	JHU/APL-OQR—82-4
	9:19935	JHU/APL-OQR—83-1
AI01-77ET20396	TRW Systems and Energy, Redondo Beach, CA (USA)	
	9:19936	PB—83-223586
AI01-77ET28383	Geological Survey, Menlo Park, CA (USA)	
	9:19950	USGS-CIRC—892
AI01-80EI10323	Bureau of the Census, Washington, DC (USA)	
	9:19676	DOE/EI/10323—T1
AI01-81FE00016	Foster-Miller Associates, Inc., Waltham, MA (USA)	
	9:19653	DOE/FE/00016—T24
AI08-78ET44802	Geological Survey, Denver, CO (USA)	
	9:19790	USGS-OFR—83-856
	9:19791	USGS-OFR—84-063
	Washington Univ., Seattle (USA)	
	9:21150	USGS-OFR—83-535
	Geological Survey, Denver, CO (USA)	
	9:21151	USGS-OFR—83-855
AI08-79DP40092	Naval Research Lab., Washington, DC (USA)	
	9:21561	NRL-MR—5221
AI79-82BP36717	Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA). Fisheries Research and Special Projects Bureau	
	9:19895	DOE/BP—225
AM01-81AD11151	Faucett (Jack) Associates, Inc., Chevy Chase, MD (USA)	
	9:19665	DOE/AD/11151—T1
AM03-76SF00010	University of California, Los Angeles, California 90024	
	9:21491	Review of Scientific Instruments 55 NO. 3. 279-331 (Mar 1984).
AM03-76SF00113	University of Southern California, Marina Del Rey (USA	
	9:20693	Nuclear Instruments and Methods in Physics Research 213 NO. 1. 123-126 (15 Jul 1983).
AP01-83CE64835	Hansen (Shirley J.) Associates, Inc., Lake Jackson, TX (USA)	
	9:20364	DOE/CE/64835—1
AS01-78ET12178	Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Coll. of Engineering	
	9:20427	DOE/ET/12178—T1
AS03-79ET27023	Univ. of Hawaii, Honolulu	
	9:20754	Health Physics 46 NO. 1. 65-71 (Jan 1984).
AS05-76ER03992	Texas Univ., Austin (USA). Center for Particle Theory	
	9:21226	DOE/ER/03992—538
	9:21227	DOE/ER/03992—539
AS05-76ER05126	Maryland Univ., College Park (USA). Dept. of Physics and Astronomy	
	9:21358	DOE/ER/05126—207
AS05-79ER10418	Georgia State Univ., Atlanta (USA). Dept. of Physics and Astronomy	
	9:21271	DOE/ER/10418—T4
AS05-79ER10459	Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy	
	9:21421	DOE/ER/10459—46
AS05-79ER10505	New Orleans Univ., LA (USA). Dept. of Chemistry	
	9:20578	DOE/ER/10505—T2
AS05-79ER10512	Tennessee Univ., Knoxville (USA)	
	9:21191	DOE/ER/10512—4
AS05-80ER10629	Oklahoma Univ., Norman (USA). Dept. of Physics and Astronomy	
	9:20674	DOE/ER/10629—T1
AS05-80ER10710	Middle Tennessee State Univ., Murfreesboro (USA)	
	9:21337	DOE/ER/10710—4
AS05-80ER10720	Texas Univ., Austin (USA). Dept. of Chemical Engineering	
	9:19871	DOE/ER/10720—14
AS05-81ER40008	Florida Univ., Gainesville (USA). Dept. of Physics	
	9:21243	DOE/ER/40008—56
AS05-81ER40036	Abilene Christian Univ., TX (USA)	
	9:21214	DOE/ER/40036—3
AS05-81ER40039	Texas A and M Univ., College Station (USA). Dept. of Physics	
	9:20675	DOE/ER/40039—7
AS05-82ER60039	George Washington Univ. Medical Center, Washington, DC	
	9:20926	Journal of Nuclear Medicine 25 NO. 2. 214-222 (Feb 1984).
AS09-76EV00902	North Carolina State Univ., Raleigh (USA)	
	9:21159	DOE/EV/00902—35

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AS09-83ER13098	**Georgia Univ., Athens (USA). Dept. of Physics and Astronomy**	
	9:21193	DOE/ER/13098—1
AS19-80BC10216	**New Mexico Inst. of Mining Technology**	
	9:19688	Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical an
AS20-81LC10678	**Arizona Univ., Tucson (USA). Dept. of Civil Engineering and Engineering Mechanics**	
	9:19715	DOE/LC/10678—1563
AS20-81LC10686	**Wyoming Univ., Laramie (USA). Dept. of Chemical Engineering**	
	9:19716	DOE/LC/10686—T1
AS20-82LC10886	**Ohio State Univ., Columbus (USA)**	
	9:20603	DOE/LC/10886—1555
AT01-76ET13376	**Massachusetts Inst. of Tech., Cambridge (USA)**	
	9:19873	DOE/ET/13376—T1
AT03-76ET51011	**GA Technologies, Inc., San Diego, CA (USA)**	
	9:21472	GA-A—17214
	9:21498	Physics of Fluids 27 NO. 2. 472-474 (Feb 1984).
	9:21546	GA-A—17174
	9:21547	GA-A—17212
	9:21548	GA-A—17373
	9:21549	GA-A—17375
AT03-76ET53055	**California Univ., Irvine (USA). Dept. of Physics**	
	9:21463	DOE/ET/53055—T2
AT03-79ER10492	**Stanford Univ., CA (USA)**	
	9:20351	DOE/ER/10492—T1
AT03-84ER53158	**GA Technologies, Inc., San Diego, CA (USA)**	
	9:21471	GA-A—17076
	9:21473	GA-A—17450
	9:21474	GA-A—17503
	9:21545	GA—A17325
AT03-84SF11964	**GA Technologies, Inc., San Diego, CA (USA)**	
	9:20618	GA-A—17426
AT06-80ET37873	**Washington Univ., Seattle (USA). Dept. of Electrical Engineering**	
	9:21625	DOE/ET/37873—1-Pt.1
AT21-81MC16472	**West Virginia Univ., Morgantown (USA)**	
	9:20699	DOE/MC/16472—T1
FC01-83FE60149	**National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)**	
	9:19684	NIPER—133-PPS-84/1
FC02-80CS30344	**Lau (Ron), Santa Cruz, CA (USA)**	
	9:19942	DOE/CS/30344—2
FC03-77SF10501	**Los Angeles County Natural History Museum Foundation, CA (USA). Section of Ornithology**	
	9:19899	DOE/SF/10501—306
FC03-82SF11676	**Amfac Energy, Inc., Honolulu, HI (USA)**	
	9:19925	DOE/SF/11676—T1
FC05-77ET10069	**Combustion Engineering, Inc., Windsor, CT (USA)**	
	9:19608	DOE/ET/10069—T87
FC07-78ID01809	**Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Systems Technology Div.**	
	9:20338	DOE/ID/01809—T1
FC07-80ID12163	**National-Standard Co., Niles, MI (USA)**	
	9:20419	DOE/ID/12163—1
FC20-79LC10036	**Occidental Oil Shale, Inc., Grand Junction, CO**	
	9:19704	Oil Shale Symposium Proceedings 267-280 (Apr 1983).
FC21-83FE60181	**North Dakota Univ., Grand Forks (USA). Energy Research Center**	
	9:19631	DOE/FE/60181—52
	9:19635	DOE/FE/60181—82
	9:19636	DOE/FE/60181—83
FG01-78CS54270	**Purdue Univ., Lafayette, IN (USA). Inst. for Interdisciplinary Engineering Studies**	
	9:20425	DOE/CS/54270—T1
FG01-78CS69031	**Energy Management Associates, Bismarck, ND (USA)**	
	9:20424	DOE/CS/69031—T1
FG01-78RG06624	**Minnesota Energy Agency, St. Paul (USA)**	
	9:19679	DOE/RG/06624—T1
FG01-79CS20245	**Delaware, County of, Media, PA (USA)**	
	9:20418	DOE/CS/20245—T1
FG01-79CS20262	**Wisconsin State Energy Office, Madison (USA)**	
	9:20329	DOE/CS/20262—T1
FG01-79CS20327	**Consumer Energy Council of America, Washington, DC**	
	9:20366	DOE/CS/20327—T1
FG01-79CS60490	**New England Board of Higher Education, Wellesley, MA (USA)**	
	9:20373	DOE/CS/60490—T1
FG01-81CS15058	**ValJim Corp., Westport, CT (USA)**	
	9:20401	DOE/CS/15058—T1
FG01-82MI10001	**National Urban League, Inc., Washington, DC (USA). Research Dept.**	
	9:20376	DOE/MI/10001—T1
FG02-79ER10546	**California State Univ., Fullerton (USA)**	
	9:19902	DOE/ER/10546—T1
FG02-81R510302	**Milltown Products, Paradise, MI (USA)**	
	9:20404	DOE/R5/10302—T1
FG02-81R510318	**Red Lake Band of Chippewa Indians, Red Lake, MN (USA)**	
	9:20377	DOE/R5/10318—T1
FG02-82ER12067		
	9:20928	CONF-8205198—(Sep 1983).
FG03-77IR01691	**California Univ., Los Angeles (USA)**	
	9:20374	DOE/IR/01691—T1
	California Univ., Los Angeles (USA). Graduate School of Education	
	9:20375	DOE/IR/01691—T2
FG22-80PC30231	**New Jersey Inst. of Tech., Newark (USA)**	
	9:19638	DOE/PC/30231—T5-Vol.1
	9:19639	DOE/PC/30231—T5-Vol.2
FG22-80PC30233	**Illinois Univ., Urbana (USA). Dept. of Civil Engineering**	
	9:19640	DOE/PC/30233—T4
FG22-80PC30265	**Lehigh Univ., Bethlehem, PA (USA). Center for Surface and Coatings Research**	
	9:19883	DOE/PC/30265—T1
FG22-81PC40807	**Southern Illinois Univ., Carbondale (USA). Dept. of Engineering Mechanics and Materials**	
	9:19661	DOE/PC/40807—T9
FG22-81PC40812	**Western Kentucky Univ., Bowling Green (USA). Dept. of Chemistry**	
	9:19617	DOE/PC/40812—T10
FG22-82PC50796	**California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering**	
	9:20604	DOE/PC/50796—T4
FG22-82PC51255	**Pennsylvania State Univ., University Park (USA). Materials Research Lab.**	
	9:20539	DOE/PC/51255—T1
FG22-83PC60785	**Kentucky Univ., Lexington (USA)**	
	9:19632	DOE/PC/60785—T1
FG22-83PC60803	**Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering**	
	9:19633	DOE/PC/60803—T1
FG44-80R410160	**Georgia Univ., Athens (USA). Dept. of Agricultural Economics**	
	9:19939	CONF-8011206—1
FG45-77CS60204	**Michigan Dept. of Commerce, Lansing (USA)**	
	9:20372	DOE/CS/60204—2
FG47-79R701000	**Iowa Conservation Commission, Des Moines (USA)**	
	9:19907	DOE/R7/01000—T1

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FG47-79R701001	Williams (Frank P.), Cedar Falls, IA (USA)	
	9:20378	DOE/R7/01001—T1
FG47-79R701010	McColl (Robert W.), Lawrence, KS (USA)	
	9:19944	DOE/R7/01010—T1
FG47-79R701014	Duffy (Ross), Topeka, KS (USA)	
	9:20379	DOE/R7/01014—T1
FG47-79R701022	Arkansas Univ., Fayetteville (USA). Dept. of Chemical Engineering	
	9:20420	DOE/R7/01022—T1
FG47-79R701038	Allen (Edward P.), Ralston, NE (USA)	
	9:20380	DOE/R7/01038—T1
FG47-79R701039	Energy Innoventions, Lincoln, NE (USA)	
	9:20381	DOE/R7/01039—T1
FG47-80R701135	Niemann (Eugene E.), Appleton City, MO (USA)	
	9:20382	DOE/R7/01135—T1
FG47-80R701136	Oak Ridge Associated Universities, Inc., TN (USA)	
	9:20405	DOE/R7/01136—T1
FG47-80R701140	DENCO Mfg. Co., Inc., Springfield, MO (USA)	
	9:20428	DOE/R7/01140—T1
FG47-80R701145	Hansen (Tim), Wichita, KS (USA)	
	9:20383	DOE/R7/01145—T1
FG47-80R701160	Benedictine Coll., Atchison, KS (USA)	
	9:19884	DOE/R7/01160—T1
FG47-80R701164	Wichita State Univ., KS (USA). Dept. of Physics	
	9:19922	DOE/R7/01164—T1
FG47-80R701169	Gilley Engineering, Inc., Lincoln, NE (USA)	
	9:20406	DOE/R7/01169—T1
FG47-80R701171	Lustgarten (Jim C.), Omaha, NE (USA)	
	9:19885	DOE/R7/01171—T1
FG47-80R701176	Windcatcher Co., Omaha, NE (USA)	
	9:19967	DOE/R7/01176—T1
FG47-81R701203	Drapac (Michael J.), Cedar Rapids, IA (USA)	
	9:19945	DOE/R7/01203—T1
FG47-81R701204	Energy Research and Information Foundation, Des Moines, IA (USA). Thoreau Center	
	9:20384	DOE/R7/01204—T1
FG47-81R701207	Westmar Coll., Le Mars, IA (USA)	
	9:19968	DOE/R7/01207—T1
FG47-81R701213	Kansas State Univ., Manhattan (USA). Dept. of Agronomy	
	9:19908	DOE/R7/01213—T1
FG47-81R701219	Olson (Richard E.), Colby, KS (USA)	
	9:19969	DOE/R7/01219—T1
FG47-81R701221	Missouri Univ., Kansas City (USA). Dept. of Physics	
	9:19970	DOE/R7/01221—T1
	Missouri Univ., Kansas City (USA)	
	9:19971	DOE/R7/01221—T2
	9:19972	DOE/R7/01221—T3
	Bryant (Paul J.), Prairie Village, KS (USA)	
	9:19973	DOE/R7/01221—T4
NAS-7-100-955392	Underwriters Labs., Inc., Melville, NY (USA)	
	9:19904	DOE/JPL/955392—2
NAS-7-100-955688	Bernd Ross Associates, San Diego, CA (USA)	
	9:19905	DOE/JPL/955688—82/10
NAS-7-100-956046	Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering	
	9:19906	DOE/JPL/956046—83/9
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16-65	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008121	MN -48	9:21013
17-59	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008092	MN -48	9:21014
17-60	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008160	MN -48	9:20871
17-61	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008477	MN -48	9:21015
17-62	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008161	MN -48	9:21016
17-63	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008153	MN -48	9:21017
17-64	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008388	MN -48	9:21018
17-65	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008132	MN -48	9:21019
18-59	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008087	MN -48	9:21020
18-60	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008135	MN -48	9:21021
18-61	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008475	MN -48	9:21022
18-63	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008134	MN -48	9:21023
18-64	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008392	MN -48	9:21024
18-65	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008119	MN -48	9:21025
19-59	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008090	MN -2	9:21619
19-60	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008393	MN -48	9:21026
19-61	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008089	MN -48	9:21027
19-62	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008394	MN -48	9:21028
19-63	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008083	MN -48	9:21029
19-64	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008395	MN -41	9:20937
20-59	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84008082	MN -48	9:21030
20-60	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008484	MN -48	9:21031
20-61	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008433	MN -48	9:21032
20-62	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008396	MN -48	9:21033
20-63	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84008464	MN -48	9:21034
20-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008099	MN -48	9:21035
21-59	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008483	MN -48	9:21036
21-61	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008397	MN -48	9:21040
21-62	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008455	MN -48	9:21041
21-63	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008398	MN -48	9:21042
21-64	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008458	MN -48	9:21043
22-59	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008156	MN -48	9:21044
22-60	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008466	MN -48	9:21047
22-61	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008106	MN -48	9:21048
22-62	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008467	MN -48	9:21049
22-63	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008107	MN -48	9:21050
23-59	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008109	MN -48	9:21051
23-60	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008460	MN -48	9:21052
23-62	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008108	MN -48	9:20873
23-63	NTIS, PC A04/MF A01; 1	DE84008456	MN -48	9:21053
24-59	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008482	MN -48	9:21054
24-63	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008471	MN -48	9:21055
25-59	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008110	MN -48	9:21056
25-60	NTIS, PC A02/MF A01	DE84008472	MN -48	9:21057
26-59	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008111	MN -41	9:20711
26-60	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008098	MN -48	9:21058
26-64	NTIS, PC A04/MF A01; 1	DE84008473	MN -48	9:21059
27-60	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008474	MN -48	9:21060
27-64	NTIS, PC A02/MF A01	DE84008479	MN -48	9:21061
28-59	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008462	MN -48	9:21062

Report No.	*Availability*	*Order No.*	*Distribution Category*	*Abstract No.*
28-60	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008461	MN -48	9:21063
29-59	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008434	MN -48	9:21064
29-64	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008465	MN -48	9:21065
30-59	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008422	MN -48	9:21067
30-64	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008423	MN -48	9:20906
31-59	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008435	MN -48	9:21068
31-64	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008431	MN -48	9:20907
32-59	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008421	MN -48	9:21069
ABCC-TR-				
1-66	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008120	MN -48	9:21070
1-67	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008100	MN -48	9:21071
2-69	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008138	MN -48	9:20908
4-65	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008112	MN -41	9:21072
4-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008113	MN -48	9:21073
5-65	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008114	MN -48	9:21074
5-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008115	MN -41	9:20712
7-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008154	MN -48	9:20896
8-65	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008127	MN -48	9:21075
9-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008128	MN -48	9:21076
11-64	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008129	MN -48	9:21077
13-65	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008130	MN -48	9:21078
14-65	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008131	MN -41	9:20909
14-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008151	MN -48	9:21079
14-67	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008137	MN -48	9:21080
16-63	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008086	MN -48	9:21081
17-66	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008122	MN -48	9:21082
17-67	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008123	MN -48	9:21083
17-68	NTIS, PC A02/M FA01 (GPO Dep.)	DE84008124	MN -48	9:20910
19-65	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008125	MN -48	9:20911
19-66	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008126	MN -48	9:21084
19-67	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008140	MN -48	9:21085
20-67	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008141	MN -48	9:21086
21-60	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008417	MN -48	9:21087
21-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008142	MN -48	9:20874
22-66	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008143	MN -48	9:21088
22-68	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008145	MN -32	9:21622
23-66	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008150	MN -48	9:21089
24-64	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008152	MN -48	9:21090
25-64	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008139	MN -48	9:21091
26-60	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008091	MN -48	9:21092
27-67	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008116	MN -48	9:21093
28-64	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008117	MN -48	9:21094
28-67	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008118	MN -48	9:21095
33-59	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008146	MN -48	9:21096
AD-A-				
134140/ 3	NTIS, PC A04/MF A01			9:21427
134193/ 2	NTIS, PC A03/MF A01			9:20705
134270/ 8	NTIS, PC A06/MF A01			9:20636
134318/ 5	NTIS, PC A03/MF A01			9:21160
134347/ 4	NTIS PC $43.50/MF $43.50			9:20706
134359/ 9	NTIS, PC A09/MF A01			9:19892
134458/ 9	NTIS, PC A03/MF A01			9:20697
134608/ 9	NTIS, PC A03/MF A01			9:21642
134611/ 3	NTIS, PC A02/MF A01			9:20672
134657/ 6	NTIS, PC A06/MF A01			9:20698
134694/ 9	NTIS, PC A02/MF A01			9:20637
134721/ 0	NTIS, PC A06/MF A01			9:20713
134726/ 9	NTIS, PC A07/MF A01			9:20714
134735/ 0	NTIS, PC A15/MF A01			9:20715
134738/ 4	NTIS, PC A03/MF A01			9:20576
134740/ 0	NTIS, PC A03/MF A01			9:20577
134758/ 2	NTIS, PC A03/MF A01			9:21457
134788/ 9	NTIS, PC A13/MF A01			9:20757
134837/ 4	NTIS, PC A02/MF A01			9:20503
134917/ 4	NTIS, PC A02/MF A01			9:20597
136403/ 3	NTIS, PC A03/MF A01			9:20357
AD-P-				
002006/ 5	NTIS, PC A02/MF A01			9:19680
002013/ 1	NTIS, PC A02/MF A01			9:19681
002034/ 7	NTIS, PC A02/MF A01			9:19634
AECL-				
5308	NTIS (US Sales Only), PC A03/MF A01	DE84900920	MN -80	9:20039
7617	NTIS (US Sales Only), PC A05/MF A01	DE84701077	MN -34C	9:21408
7797	AECL Whiteshell Nuclear Research Est., Pinawa, Manitoba, Canada		ND -70	9:19737
AERE-M-				
3312	NTIS (US Sales Only), PC A02/MF A01	DE84700736	MN -25	9:20432
3316	NTIS (US Sales Only), PC A02/MF A01	DE84700744	MN -25	9:21402
AERE-R-				
6463	HMSO, London, price, $2.00		ND -86	9:19729
10774	HMSO, London price, $2.00		ND -41	9:19825
10848	NTIS (US Sales Only), PC A03/MF A01	DE84701048	MN -34A	9:21183
10935	HMSO, London, price, $2.00		ND -25	9:20040
AERE-TP-				
991	NTIS (US Sales Only), PC A02/MF A01	DE84700745	MN -25	9:20504

Report No.	Availability	Order No.	Distribution Category	Abstract No.
AMPC-				
14-006	NTIS, PC A02/MF A01 (GPO Dep.)	DE84001861	MN -20b	9:21458
ANL-				
83-11-Vol.4	*See* NUREG/CR-3359-Vol.4	DE84008285	MN -79p	9:20160
83-84	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009114	STD -70	9:19811
ANL/CNSV-TM-				
125	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84009134	MN -95e	9:19888
127	NTIS, PC A05/MF A01 (GPO Dep.)	DE84007083	MN -61A	9:19901
ANL/EES-TM-				
241	*See* NUREG/CR-3667	DE84009227	MN -80	9:20323
ANL/FE-				
83-18	NTIS, PC A07/MF A01 (GPO Dep.)	DE84009135	STD -90a	9:19605
83-26	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009116	STD -90c	9:19606
ANL/FPP/TM-				
172	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008988	STD -20	9:21530
179	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009126	STD -20	9:21531
180	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009125	STD -20	9:21532
ANL/NDM-				
84	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009493	MN -34C	9:20537
ANL-OHS/HP-				
84-101	*See* DOE/EV-0005-46	DE84009123	STD -70A	9:20143
ARBRL-TR-				
02527	*See* AD-A-134740/0			9:20577
02528	*See* AD-A-134738/4			9:20576
ARH-SA-				
49	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009048	MN -10	9:19738
BAW-				
1806	*See* DOE/ET/34019-3	DE84010228	STD -78	9:20007
BMFT-FB-T-				
83-229	NTIS (US Sales Only), PC A07/MF A01; 1	DE84750726	MN -95d	9:20616
83-255	NTIS (US Sales Only), PC A04/MF A01; 1	DE84750725	MN -95d	9:20358
83-265	NTIS (US Sales Only), PC A07/MF A01; 1	DE84750727	MN -95	9:19976
BMI/ONWI-				
523	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84010105	STD -70	9:19739
BNL-				
33239	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007696	MN -48	9:21138
33765	NTIS MF A01; 2 (GPO Dep.)	DE84002695	MN -25	9:20433
34081	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010217	MN -63	9:19921
34251	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007385	MN -25	9:20505
34314	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010220	MN -34	9:20638
34315	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008180	MN -34D	9:21213
BNL-NUREG-				
51454-Vol.3-No.2	*See* NUREG/CR-2331-Vol.3-No.2	DE84008056	MN -80	9:20159
51733	*See* NUREG/CR-3603	DE84009542	MN -79p	9:20082
51737	*See* NUREG/CR-3628	DE84009543	MN -80	9:20163
BNL-tr-				
1027	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009548	MN -28	9:20635
CAES-				
692-83	*See* DOE/MC/16359-1521	DE84004863	STD -90i	9:19637
CBPF-MO-				
003/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84701052	MN -34B	9:21161
005/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701029	MN -34A	9:21184
CBPF-NF-				
009/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84700990	MN -34D	9:21428
014/ 82	NTIS (US Sales Only), PC A04/MF A01	DE84701024	MN -34D	9:21253
014/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701056	MN -34B	9:21162
017/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701035	MN -34A	9:21417
018/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701045	MN -34A	9:20434
019/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84700991	MN -34D	9:21163
023/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701067	MN -34D	9:21225
024/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701046	MN -34A	9:20435
026/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84700992	MN -34D	9:21164
027/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84701020	MN -34D	9:21429
030/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84700993	MN -34D	9:21447
030/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84700994	MN -34D	9:21254
032/ 83	NTIS (US Sales Only), PC A03/MF A01	DE84701036	MN -34A	9:21418
034/ 82	NTIS (US Sales Only), PC A04/MF A01	DE84701086	MN -34C	9:21357
037/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84700995	MN -34D	9:21255
038/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701025	MN -34D	9:21430
041/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84700996	MN -34D	9:21419
042/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84700997	MN -34D	9:21420
043/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84700998	MN -34D	9:21256
044/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84700999	MN -34D	9:21431
045/ 82	NTIS (US Sales Only), PC A04/MF A01	DE84701062	MN -34B	9:21165
047/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701000	MN -34D	9:21448
CERN-				
83-08	NTIS (US Sales Only), PC A03/MF A01	DE84701078	MN -34C	9:20695
CNLM-				
1311	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010195	MN -33	9:20100
1384	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010202	MN -33	9:20101
1429	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010210	MN -33	9:20102
1441	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010207	MN -33	9:20103
2354-Suppl.1	NTIS, PC A02; 3 (GPO Dep.)	DE84007141	MN -33	9:20104
2413	NTIS, PC A03; 3 (GPO Dep.)	DE84007007	MN -33	9:20105
2481	NTIS, PC A02; 3 (GPO Dep.)	DE84007142	MN -33	9:20106

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3069	NTIS, PC A02; 3 (GPO Dep.)	DE84007150	MN -33	9:20107
3833	NTIS, PC A02; 3 (GPO Dep.)	DE84007660	MN -33	9:20108
3938	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007652	MN -33	9:20322
3951	NTIS, PC A02; 3 (GPO Dep.)	DE84007651	MN -33	9:20072
3951-Suppl.1	NTIS, PC A02; 3 (GPO Dep.)	DE84007654	MN -33	9:20073
3955	NTIS, PC A02; 3 (GPO Dep.)	DE84007653	MN -33	9:20109
3968	NTIS, PC A02; 3 (GPO Dep.)	DE84007657	MN -33	9:20110
4050	NTIS, PC A02; 3 (GPO Dep.)	DE84007617	MN -33	9:20111
4051	NTIS, PC A02; 3 (GPO Dep.)	DE84007621	MN -33	9:20112
4103	NTIS, PC A02; 3 (GPO Dep.)	DE84007616	MN -33	9:20113
4177	NTIS, PC A02; 3 (GPO Dep.)	DE84007640	MN -33	9:20074
4272	NTIS, PC A02; 3 (GPO Dep.)	DE84007643	MN -33	9:20114
4290	NTIS, PC A02; 3 (GPO Dep.)	DE84007636	MN -33	9:20115
4290-Suppl.1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007638	MN -33	9:20116
5233	NTIS, PC A02; 3 (GPO Dep.)	DE84006943	MN -33	9:20117
5272	NTIS, PC A02; 3 (GPO Dep.)	DE84006896	MN -33	9:20023
5365-Suppl.1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007024	MN -33	9:20118
5646	NTIS, PC A02; 3 (GPO Dep.)	DE84007038	MN -33	9:20119
5709-Rev.	NTIS, PC A02; 3 (GPO Dep.)	DE84007033	MN -33	9:20120
5709-Suppl.0	NTIS, PC A02; 3 (GPO Dep.)	DE84007034	MN -33	9:20121
5709-Suppl.13	NTIS, PC A03; 3 (GPO Dep.)	DE84007115	MN -33	9:20122
5709-Suppl.14	NTIS, PC A03; 3 (GPO Dep.)	DE84007120	MN -33	9:20123
5709-Suppl.15	NTIS, PC A03; 3 (GPO Dep.)	DE84007122	MN -33	9:20075
5709-Suppl.20	NTIS, PC A03; 3 (GPO Dep.)	DE84007111	MN -33	9:20124
5742	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007123	MN -33	9:20125
5752-Suppl.2	NTIS, PC A02; 3 (GPO Dep.)	DE84007110	MN -33	9:20126
5752-Suppl.4	NTIS, PC A02; 3 (GPO Dep.)	DE84007108	MN -33	9:20076
5754-Suppl.5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007107	MN -33	9:20127
5754-Suppl.13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007140	MN -33	9:20128
5777	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007131	MN -33	9:20077
5787	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007137	MN -33	9:20078
CONF-700995-	(2. international conference on zeolites, Worchester, MA, USA, 7-9 Sep 1970)			
1	*See* ARH-SA-49	DE84009048	MN -10	9:19738
CONF-770303-	(Corrosion/77 NACE meeting, San Francisco, CA, USA, 14-18 Mar 1977)			
3	*See* UCRL-78910		MN -32	9:21638
CONF-7804213-	(7. annual conference of the National Association for Environmental Education, Chicago, IL, USA, 30 Apr-2 May 1978)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009389	MN -11	9:20321
CONF-7905236-	(Meeting on VUV and soft x-ray instrumentation for the photon factory, Oho, Ibaraki, Japan, 21 May 1979)			
	See KEK-81-8	DE84780148	MN -28	9:20660
CONF-8007147-	(15. annual seminar on theoretical physics, Johannesburg, South Africa, 10-12 Jul 1980)			
	See INIS-mf-8696	DE84780102	MN -34D	9:21439
CONF-800980-	(Applied superconductivity conference, Santa Fe, NM, USA, 29 Sep-2 Oct 1980)			
55	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007241	MN -20	9:21533
CONF-8011204-	(Workshop on first wall coating, Nagoya, Japan, 28 Nov 1980)			
	See IPPJ-551	DE84780099	MN -25	9:21555
CONF-8011206-	(Energy saving equipment and stray voltage on dairy farms conference, Monroe, GA, USA, 14 Nov 1980)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84000779	MN -59a	9:19939
CONF-8102102-	(Meeting on research technology, Kumatori, Osaka, Japan, 10 Feb 1981)			
	See KURRI-TR-219	DE84780149	MN -80	9:20045
CONF-8103183-	(Workshop on physics with 12 GeV PS at KEK, Oho, Ibaraki, Japan, 9 Mar 1981)			
	See KEK-81-23	DE84780110	MN -34D	9:21274
CONF-8105236-	(Meeting on pulsed structure of synchrotron radiation and its applications, Oho, Ibaraki, Japan, 29 May 1981)			
	See KEK-81-16	DE84780098	MN -34A	9:21198
CONF-8105244-	(Cherwell-Simon Memorial conference, Oxford, UK, 8 May 1981)			
1	*See* SLAC-PUB-3288	DE84006776	MN -34D	9:21223
CONF-810624-	(22. US symposium on rock mechanics, Cambridge, MA, USA, 29 Jun-2 Jul 1981)			
	Massachusetts Inst. of Tech., Cambridge, MA 02139			9:21154
CONF-8107121-	(1. workshop on detectors for TRISTAN positron-electron physics, Oho, Ibaraki, Japan, 9 Jul 1981)			
	See KEK-81-12	DE84780111	MN -34D	9:21221
CONF-8107122-	(Meeting on heavy and light ion irradiations and radiation measurement, Tanashi, Tokyo, Japan, 2 Jul 1981)			
	See INS-NUMA-29	DE84780112	MN -34C	9:21405
CONF-8107123-	(Meeting on measurement in NUMAIRON project and data processing system, Tokyo, Japan, 13 Jul 1981)			
	See INS-NUMA-31	DE84780113	MN -34C	9:20622
CONF-8107124-	(16. annual seminar on theoretical physics, Port Elizabeth, South Africa, 14-16 Jul 1981)			
	See INIS-mf-8696	DE84780102	MN -34D	9:21439

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CONF-8108164-	(7. conference of Czechoslovak physicists, Prague, Czechoslovakia, 24-28 Aug 1981)			
Pt.1-Vol.1	*See* INIS-mf-8703	DE84780103	MN -34D	9:21270
CONF-811040-	(9. symposium on engineering problems of fusion research, Chicago, IL, USA, 26-29 Oct 1981)			
207-Draft	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007550	MN -20a	9:21459
208-Draft	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007535	MN -20b	9:21534
209	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007548	MN -20c	9:21535
210-Draft	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006578	MN -20	9:21536
CONF-811101-	(Winter annual meeting of the American Society of Mechanical Engineers, Washington, DC, USA, 15-20 Nov 1981)			
35	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007559	MN -20b	9:21537
CONF-811113-	(American Vacuum Society national symposium, Anaheim, CA, USA, 3-6 Nov 1981)			
58	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007533	MN -25	9:20436
CONF-811294-	(Meeting on physics and chemistry of organo polymer semiconductors, Kumatori, Osaka, Japan, 18 Dec 1981)			
	See KURRI-TR-217	DE84780100	MN -25	9:20515
CONF-8203159-	(9. JUICE meeting on heavy water reactors, Tokyo, Japan, 11 Mar 1982)			
	See PNC-G-065-82-01	DE84780150	MN -80	9:20022
CONF-820460-	(1. Brazilian symposium on photonuclear physics, Sao Paulo, Brazil, 5-7 Apr 1982)			
2	*See* IFUSP-P-350	DE84701087	MN -34C	9:21363
CONF-820667-	(5. international workshop on HgI/sub 2/ nuclear radiation detectors, Jerusalem, Israel, 6-8 Jun 1982)			
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	Nucl. Instrum. Methods Phys. Res., 213: No. 1, 103-105(15 Jul 1983)			9:20690
	Nucl. Instrum. Methods Phys. Res., 213: No. 1, 107-113(15 Jul 1983)			9:20691
	Nucl. Instrum. Methods Phys. Res., 213: No. 1, 115-122(15 Jul 1983)			9:20692
	Nucl. Instrum. Methods Phys. Res., 213: No. 1, 123-126(15 Jul 1983)			9:20693
	Nucl. Instrum. Methods Phys. Res., 213: No. 1, 127-132(15 Jul 1983)			9:20694
CONF-821049-	(TMS/AIME fall meeting(Radiation damage analysis for fusion reactors), St. Louis, MO, USA, 24-28 Oct 1982)			
	J. Nucl. Mater., 117: 4-11(Jul 1983)			9:20481
	J. Nucl. Mater., 117: 46-54(Jul 1983)			9:20482
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	J. Nucl. Mater., 117: 276-286(Jul 1983)			9:21594
12	J. Nucl. Mater., 117: 113-117(Jul 1983)			9:20484
CONF-8210133-	(8. All-Union conference on charged particles accelerators, Protvino, USSR, 19-21 Oct 1982)			
4	*See* JINR-R-9-82-565	DE84700791	MN -28	9:20658
CONF-8211149-	(Round table meeting on chemical and physical valorization of coal, Brussels, Belgium, 16 Nov 1982)			
	See EUR-8508-DE			9:19619
CONF-821253-	(Topical meeting on progress in the solution of quantum gauge theories, Trieste, Italy, 17-22 Dec 1982)			
	Nucl. Phys. B, 225: No. 3, 377-390(28 Nov 1983)			9:21266
CONF-830162-	(ASME-EPRI radwaste workshop, Charlotte, NC, USA, 31 Jan-2 Feb 1983)			
	See EPRI-NP-3222		ND -70B	9:19779
CONF-830305-	(SPE symposium on low permeability, Denver, CO, USA, 14-16 Mar 1983)			
	Soc. Pet. Eng. AIME, Pap., SPE/DOE 11627: 249-256(Mar 1983)			9:19672
	Soc. Pet. Eng. AIME, Pap., SPE/DOE 11634: 305-318(Mar 1983)			9:19673
	Soc. Pet. Eng. AIME, Pap., SPE/DOE 11623: 201-212(Mar 1983)			9:19688
CONF-8303121-	(Microscopy of semiconducting materials meeting, Oxford, UK, 21-23 Mar 1983)			
2	*See* LBL-17320	DE84009244	MN -25	9:20516
CONF-8303126-	(Workshop on planning for residential load management, Atlanta, GA, USA, 7-8 Mar 1983)			
	See EPRI-EM-3227		ND -97b	9:20339
CONF-8303136-	(Railroad slurry pipeline meeting, Richlands, VA, USA, 31 Mar 1983)			
	NTIS, PC A06/MF A01; 1	DE84900865	MN -90j	9:19658
CONF-830419-	(16. rare earth research conference, Tallahassee, FL, USA, 18-21 Apr 1983)			
	J. Less-Common Met., 93: No. 2, 277(15 Sep 1983)			9:20557
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CONF-830425-	(Society of Photo-Optical Instrumentation Engineers conference, Santa Fe, NM, USA, 11-15 Apr 1983)			
37	*See* DOE/ER/10978-4	DE84008273	MN -34	9:20509
CONF-830434-	(16. oil shale symposium, Golden, CO, USA, 13-15 Apr 1983)			
	Oil Shale Symp. Proc., 437-450(Apr 1983)			9:19697
	Oil Shale Symp. Proc., 451-468(Apr 1983)			9:19701
	Oil Shale Symp. Proc., 199-206(Apr 1983)			9:19702
	Oil Shale Symp. Proc., 228-241(Apr 1983)			9:19703
	Oil Shale Symp. Proc., 267-280(Apr 1983)			9:19704
	Oil Shale Symp. Proc., 281-295(Apr 1983)			9:19705
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	Oil Shale Symp. Proc., 335-344(Apr 1983)			9:19707
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	Oil Shale Symp. Proc., 207-227(Apr 1983)			9:19717
	Oil Shale Symp. Proc., 498-511(Apr 1983)			9:19718
	Oil Shale Symp. Proc., 534-540(Apr 1983)			9:19720
	Oil Shale Symp. Proc., 541-549(Apr 1983)			9:19721
CONF-830451-	(American Ceramic Society annual meeting, Chicago, IL, USA, 25-28 Apr 1983)			
29	*See* HEDL-SA-2892-FP	DE84003952	MN -79	9:19727
CONF-8304144-	(23. conference on nuclear spectroscopy and nuclear structure, Moscow, USSR, 19-21 Apr 1983)			
Summs.	*See* INIS-SU-198	DE84780104	MN -34D	9:21273
CONF-8305180-	(American Geophysical Union meeting, Baltimore, MD, USA, 30 May-3 Jun 1983)			
1	*See* RHO-BW-SA-302AP	DE83014644	MN -70	9:19785
CONF-830607-	(American Society of Mechanical Engineers pressure vessel and piping conference, Portland, OR, USA, 19-24 Jun 1983)			
33	*See* HEDL-SA-2841	DE84003949	MN -80	9:20150
CONF-830617-	(76. annual meeting of the Air Pollution Control Association, Atlanta, GA, USA, 19-24 Jun 1983)			
6-Rev	*See* LBL-15878-Rev.	DE84009243	MN -41	9:20721
CONF-830641-	(3. annual advanced gasification projects contractors' meeting, Morgantown, WV, USA, 28-30 Jun 1983)			
	See DOE/METC-84-8	DE84000217	STD -90c	9:19613
CONF-830665-	(Health Physics Society summmer school on internal radiation dosimetry, Catonsville, MD, USA, 12-17 Jun 1983)			
4	*See* DP-MS-84-29	DE84010151	MN -48	9:21098
CONF-8306152-	(Workshop on fusion blanket technology, Erice, Italy, 6-10 Jun 1983)			
	Nucl. Fusion, 23: No. 11, 1507-1512(Nov 1983)			9:21588
CONF-8306184-	(IEEE microwave symposium, Boston, MA, USA, 1-3 Jun 1983)			
1	*See* BNL-33239	DE84007696	MN -48	9:21138
CONF-830718-	(International Europhysics conference on high energy physics, Brighton, UK, 20-27 Jul 1983)			
19	*See* BNL-34315	DE84008180	MN -34D	9:21213
CONF-830780-	(International conference on atomic collisions in solids, Bad Iburg, F.R. Germany, 18-22 Jul 1983)			
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84003204	MN -34A	9:21185
CONF-8307112-	(American Mathematical Society research conference on fluids and plasmas: geometry and dynamics, Boulder, CO, USA, 17-23 Jul 1983)			
2	*See* LBL-17148	DE84008243	MN -20f	9:21481
CONF-830827-	(9. annual symposium on underground coal gasification, Bloomingdale, IL, USA, 7-10 Aug 1983)			
	See DOE/METC-84-7	DE84003052	STD -90c	9:19612
CONF-830898-	(1. conference on energy from biomass: building on a generic technology base, Argonne, IL, USA, 22-24 Aug 1983)			
	See ANL/CNSV-TM-127	DE84007083	MN -61A	9:19901
CONF-8308106-	(5. annual participants information meeting of DOE low level waste management program, Denver, CO, USA, 30 Aug-1 Sep 1983)			
	NTIS, PC A99/MF A01 (GPO Dep.)	DE84004134	MN -70B	9:19742
CONF-8308110-	(6. international congress on photosynthesis, Brussels, Belgium, 1-6 Aug 1983)			
8	*See* LBL-17380	DE84009216	MN -4	9:20566
CONF-8308126-	(NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal, Reston, VA, USA, 30 Aug-1 Sep 1983)			
5	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009204	MN -70	9:19771
CONF-8308163-	(Annual Illuminating Engineering Society conference, Los Angeles, CA, USA, 8-11 Aug 1983)			
1	*See* LBL-15382	DE84009238	MN -95d	9:20387
CONF-8309198-	(Inter-regional training course on uranium exploration and evaluation, Skofja Loka, Yugoslavia, 5 Sep-7 Oct 1983)			
1	*See* IAEA-RL-102	DE84700731	MN -4	9:20542
CONF-8309222-	(7. Europe and row annual muse meeting, London, UK, 27 Sep 1983)			
1	*See* GA-A-17174	DE84009018	MN -20d	9:21546
CONF-831015-	(Nuclear science symposium, San Francisco, CA, USA, 19-21 Oct 1983)			
41	*See* SLAC-PUB-3298	DE84007804	MN -34D	9:20678
42	*See* UCRL-89119	DE84007761	MN -21	9:21574

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	Trans. Am. Nucl. Soc., 45: 258-259(Oct 1983)			9:20231
	Trans. Am. Nucl. Soc., 45: 260(Oct 1983)			9:20232
	Trans. Am. Nucl. Soc., 45: 260-261(Oct 1983)			9:20233
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	Trans. Am. Nucl. Soc., 45: 332(Oct 1983)			9:20250
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	Trans. Am. Nucl. Soc., 45: 333-334(Oct 1983)			9:20252
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	Trans. Am. Nucl. Soc., 45: 587(Oct 1983)			9:20325
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	Trans. Am. Nucl. Soc., 45: 784-785(Oct 1983)			9:20596
	Trans. Am. Nucl. Soc., 45: 624-625(Oct 1983)			9:21590
CONF-8310178-	(2. international conference and workshop on radiative properties of hot dense matter, Sarasota, FL, USA, 31 Oct-4 Nov 1983)			
5	*See* UCRL-89868	DE84009857	MN -34A	9:21583
CONF-8310182-	(US fall DECUS symposium, Las Vegas, NV, USA, 24-28 Oct 1983)			
13	*See* FERMILAB/TM-1244	DE84009411	MN -28	9:20644
14	*See* FERMILAB/TM-1243	DE84009406	MN -28	9:20643
15	*See* FERMILAB/TM-1240	DE84009403	MN -28	9:20641
CONF-8310227-	(Monopole '83 conference, Ann Arbor, MI, USA, 6-9 Oct 1983)			
6	*See* DOE/ER/40039-7	DE84007463	MN -34D	9:20675
CONF-8310260-	(Honeywell Large Systems Users Association forum XXXVII, San Diego, CA, USA, 16-19 Oct 1983)			
1	*See* GEPP-OP-754a	DE84008021	MN -13	9:21627
CONF-831106-	(Topical meeting on safeguards technology - the process safeguards interface, Hilton Head Island, SC, USA, 28 Nov-1 Dec 1983)			
	Trans. Am. Nucl. Soc., Suppl., 45: 6-7(Dec 1983)			9:19834
	Trans. Am. Nucl. Soc., Suppl., 45: 7(Dec 1983)			9:19835
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	Trans. Am. Nucl. Soc., Suppl., 45: 15-16(Dec 1983)			9:19845
24	*See* Y/DW-441	DE84007684	MN -15	9:19833
CONF-831112-	(Coal technology '83 - international coal utilization convention, Houston, TX, USA, 15-17 Nov 1983)			
5	Phillips Coal Co., 2929 N. Central Expressway, Richardson, TX 75080		MN -88	9:19652
6	NTIS (US Sales Only), PC A02/MF A01	DE84900852	MN -98A	9:20336
CONF-831187-	(29. annual conference on magnetics and magnetic materials, Pittsburgh, PA, USA, 8-11 Nov 1983)			
17	*See* BNL-33765	DE84002695	MN -25	9:20433
18	*See* BNL-34251	DE84007385	MN -25	9:20505
CONF-831195-	(International congress on applications of lasers and electro-optics, Los Angeles, CA, USA, 14-17 Nov 1983)			
7	*See* UCRL-89569	DE84008326	MN -21	9:21582
CONF-8311104-	(Physics of explosives technical meeting, Unterluss, F.R. Germany, 2-4 Nov 1983)			
2	*See* UCRL-89846	DE84002782	MN -45	9:20709
CONF-8311143-	(Canadan fall DECUS symposium, Calgary, Alberta, Canada, 28-30 Nov 1983)			
1	*See* TRI-PP-83-119	DE84900953	MN -28	9:20661
CONF-8311144-	(Los Alamos meson physics facility users group meeting, Los Alamos, NM, USA, 7-8 Nov 1983)			
1	*See* DOE/ER/05126-207	DE84008018	MN -34D	9:21358
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
113	*See* LBL-17017	DE84006769	MN -20a	9:21560
114	*See* EGG-M-10783	DE84005053	MN -20	9:21544
116	*See* UCRL-89274	DE84008298	MN -20d	9:21580
118	*See* UCRL-89291	DE84008059	MN -21	9:21581
124	*See* GA-A-17212	DE84009039	MN -20d	9:21547
128	*See* GA-A-17214	DE84009020	MN -20d	9:21472
129	*See* UCRL-89240	DE84009108	MN -20	9:21576
130	*See* UCRL-89233	DE84009105	MN -20	9:21489
131	*See* UCRL-89241	DE84009085	MN -20	9:21577
132	*See* UCRL-89230	DE84009087	MN -20	9:21575
133	*See* UCRL-89245	DE84009086	MN -20	9:21579
134	*See* UCRL-89242	DE84009538	MN -20a	9:21578
135	*See* GA-A-17375	DE84009472	MN -20a	9:21549
CONF-831254-	(Agricultural electronics - 1983 and beyond conference, Chicago, IL, USA, 11-12 Dec 1983)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009154	MN -34A	9:21403
CONF-831264-	(Workshop on accelerator physics issues for a superconducting super collider, Ann Arbor, MI, USA, 12-17 Dec 1983)			
10	*See* LBL-17253	DE84009217	MN -34A	9:20634
12	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007267	MN -28	9:20624
13	*See* LBL-17050	DE84009224	MN -28	9:20623
CONF-831267-	(Workshop on supersymmetry in physics, Los Alamos, NM, USA, 15-20 Dec 1983)			
2	*See* DOE/ER/40008-56	DE84007289	MN -34D	9:21243
CONF-831268-	(8. energy from biomass and wastes meeting, Lake Buena Vista, FL, USA, 10 Dec 1983)			
1	*See* PNL-SA-11878	DE84006580	MN -61D	9:19887
CONF-840124-	(American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting, Atlanta, GA, USA, 29 Jan-1 Feb 1984)			
6	*See* LBL-16036	DE84009215	MN -95d	9:20388
CONF-840139-	(SPIE technical symposium and instrument exhibit, Los Angeles, CA, USA, 22-27 Jan 1984)			
4	*See* LA-UR-84-1104	DE84009998	MN -37	9:20565
CONF-840140-	(International symposium on solid state physics under pressure, Izu-Nagaoka, Japan, 18-21 Jan 1984)			
2	NTIS, PC A02; 3 (GPO Dep.)	DE84009162	MN -25	9:20555
CONF-840149-	(IAEA technical committee meeting, Princeton, NJ, USA, 16-20 Jan 1984)			
1	*See* GA-A17325	DE84009092	MN -20a	9:21545
CONF-840202-	(17. midyear topical meeting of the Health Physics Society, Pasco, WA, USA, 5-9 Feb 1984)			
22	*See* PNL-SA-11890	DE84008303	MN -41	9:20677
CONF-840218-	(113. annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers, Los Angeles, CA, USA, 26 Feb-2 Mar 1984)			
4	*See* DP-MS-83-85	DE84008301	MN -80	9:19857
CONF-840255-	(6. US-Japan symposium on compact toroid research, Princeton, NJ, USA, 20-23 Feb 1984)			
11	*See* LA-UR-84-630	DE84007285	MN -20g	9:21559
15	*See* LA-UR-84-632	DE84007467	MN -20g	9:21480
16	*See* LA-UR-84-631	DE84007449	MN -20g	9:21479
17	*See* LA-UR-84-524	DE84007485	MN -20f	9:21478
CONF-840257-	(DOE nuclear reactor and facility safety conference, Rockville, MD, USA, 27-29 Feb 1984)			
3	*See* DP-MS-84-16	DE84009078	MN -41	9:19827
CONF-840264-	(Workshop on high energy excitations in condensed matter, Los Alamos, CA, USA, 13-15 Feb 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009205	MN -37	9:20673

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CONF-840265-	(US-Japan workshop on heliotron-E results, Kyoto, Japan, 13-17 Feb 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007523	MN -20b	9:21538
CONF-840266-	(Heat pumps: an update on research and applications seminar, New Orleans, LA, USA, 23-24 Feb 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007561	MN -95d	9:20359
CONF-840269-	(NAPAP Task Group G peer review meeting, Burlington, VT, USA, 14-17 Feb 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007300	MN -25	9:20437
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007298	MN -25	9:20506
CONF-840270-	(International Standards Organization meeting, Geneva, Switzerland, 1-10 Feb 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007604	MN -32	9:21623
CONF-840271-	(2. Israel materials engineering conference, Beer-Sheva, Israel, 22-23 Feb 1984)			
1	*See* DOE/ER/03158-117	DE84009142	MN -25	9:20439
CONF-840272-	(5. international neutron transmutation doping conference, San Jose, CA, USA, 9 Feb 1984)			
1	*See* EGG-M-12583	DE84007664	MN -78	9:20079
2	*See* EGG-M-14083	DE84007665	MN -78	9:20080
CONF-840302-	(11. annual energy technology conference and exposition, Washington, DC, USA, 19-21 Mar 1984)			
1	*See* GA-A-17426	DE84009138	MN -90e	9:20618
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009158	MN -61F	9:19889
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009184	MN -90f	9:20617
CONF-840307-	(Waste management '84, Tucson, AZ, USA, 11-15 Mar 1984)			
20	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009160	MN -70	9:19740
CONF-840311-	(4. international symposium on heating in toroidal plasmas, Rome, Italy, 21-28 Mar 1984)			
1	*See* GA-A-17450	DE84007292	MN -20a	9:21473
CONF-840370-	(US/Japan workshop on 3-D MHD studies, Oak Ridge, TN, USA, 19-23 Mar 1984)			
2	*See* GA-A-17503	DE84009400	MN -20a	9:21474
CONF-840371-	(International conference on acoustics, speech and signal processing, San Diego, CA, USA, 19-21 Mar 1984)			
3	*See* SAND-84-0668C	DE84009954	MN -37	9:20700
CONF-840386-	(9. US TRIGA owner-user conference, Anaheim, CA, USA, 12 Mar 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009182	MN -38	9:20608
CONF-840387-	(2. topical meeting on laser techniques in the extreme ultraviolet, Boulder, CO, USA, 5-7 Mar 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009150	MN -34A	9:21186
CONF-840395-	(Workshop on semi-classical methods in nuclear physics, Grenoble, France, 5-8 Mar 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007359	MN -34C	9:21353
CONF-840396-	(International conference on instrumenhtation for colling beam physics, Novosibirsk, USSR, 15-21 Mar 1984)			
1	*See* SLAC-PUB-3299	DE84008203	MN -34D	9:20679
CONF-840397-	(G.V. Raynor memorial conference on alloy phases - theory and practice, Birmingham, UK, 30 Mar 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009190	MN -25	9:20429
CONF-840402-	(6. annual ASME Solar Energy Division technical conference, Las Vegas, NV, USA, 10-12 Apr 1984)			
5	*See* BNL-34081	DE84010217	MN -63	9:19921
CONF-840408-	(5. international conference on nuclear methods in environmental and energy research, Mayaguez, Puerto Rico, 2-6 Apr 1984)			
3	*See* UCRL-89824	DE84009539	MN -4	9:19847
CONF-840411-	(3. meeting on liquid metal in energy applications, Oxford, UK, 9-13 Apr 1984)			
17	*See* UCRL-88213	DE84009536	MN -21	9:21573
CONF-840412-	(American power conference, Chicago, IL, USA, 24-26 Apr 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009187	MN -79p	9:20049
CONF-840415-	(187. national meeting of the American Chemical Society, St. Louis, MO, USA, 8-13 Apr 1984)			
17	*See* DOE/ER/10720-14	DE84009146	MN -92	9:19871
18	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009206	MN -34A	9:21187
CONF-840455-	(Atomic Industrial Forum fuel cycle '84, Atlanta, GA, USA, 1-4 Apr 1984)			
1	*See* SAND-84-0648C	DE84009445	MN -70	9:19788
CONF-8404105-	(North Dakota Academy of Science conference, Fargo, ND, USA, 26-28 Apr 1984)			
6	*See* DOE/FE/60181-83	DE84009349	MN -90i	9:19636
7	*See* DOE/FE/60181-82	DE84009350	MN -90i	9:19635
CONF-8404106-	(International symposium on the properties and applications of metal hydrides, Eilat, Israel, 9-13 Apr 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009159	MN -25	9:20487
CONF-8404109-	(IEEE symposium on security and privacy, Oakland, CA, USA, 30 Apr-2 May 1984)			
2	*See* SAND-83-2564C	DE84010148	MN -21	9:21566
CONF-8404116-	(21. space congress, Cape Kennedy, FL, USA, 24-26 Apr 1984)			
1	*See* LA-UR-84-745	DE84007481	MN -38	9:20584

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CONF-8404117-	(7. DOE computer security conference, Kansas City, MO, USA, 11 Apr 1984)			
1	*See* LA-UR-84-470	DE84007507	MN -32	9:21630
CONF-8404118-	(Radiation epidemilogy contractors workshop, Rockville, MD, USA, 13-14 Apr 1984)			
1	*See* PNL-SA-10247	DE84008305	MN -41	9:21116
CONF-8404120-	(Association of system 2000 users for technical exchange conference, Austin, TX, USA, 30 Apr-4 May 1984)			
1	*See* SAND-84-0704C	DE84009491	MN -70	9:19789
CONF-840504-	(Southeastern conference on theoretical and applied mechanics, Pine Mountain, GA, USA, 10-11 May 1984)			
1	*See* K/TS-11-111	DE84005066	MN -34	9:21208
CONF-840506-	(2. international energy exposition and conference - ENERGEX '84, Regina, Canada, 14-19 May 1984)			
1	S; 3 (GPO Dep.)	DE84007549	MN -95d	9:20360
CONF-840512-	(6. congress of the International Radiation Protection Association, Berlin, F.R. Germany, 7-12 May 1984)			
1	*See* UCRL-88392	DE83016575	MN -37	9:20680
2	*See* UCRL-89778	DE83017837	MN -11	9:20863
3	NTIS, PC A02/MF A01	DE83017940	MN -48	9:21097
4	*See* UCRL-89896	DE84002009	MN -11	9:20681
5	*See* UCRL-88450	DE84002720	MN -11	9:20813
6	*See* UCRL-88391	DE84002458	MN -41	9:21415
7	NTIS, PC A02/MF A01	DE84003637	MN -70B	9:19741
CONF-840515-	(International symposium and workshop on dynamic duties of energy storage plants, Boston, MA, USA, 7-11 May 1984)			
1	*See* LA-UR-84-52	DE84006006	MN -20b	9:20303
CONF-840516-	(International symposium on aging in tests of safety equipment for nuclear power plants, Paris, France, 15-16 May 1984)			
1	*See* SAND-83-1854C	DE84006485	MN -80	9:20499
2	*See* SAND-83-2019C	DE84006713	MN -80	9:20501
3	*See* SAND-83-2018C	DE84006721	MN -80	9:20164
4	*See* SAND-83-2017C	DE84006723	MN -80	9:20500
5	*See* SAND-83-2085C	DE84006966	MN -80	9:20502
CONF-840529-	(Linear accelerator conference, Darmstadt-Seeheim, F.R. Germany, 7-11 May 1984)			
1	*See* EGG-10282-2013	DE84005034	MN -28	9:20627
3	*See* EGG-10282-2012	DE84007584	MN -28	9:20626
CONF-840539-	(25. annual ADCIS conference, Columbus, OH, USA, 14-18 May 1984)			
1	*See* LA-UR-83-2885	DE84001177	MN -32	9:21629
CONF-840555-	(Spring meeting of the Electrochemical Society, Cincinnati, OH, USA, 6-11 May 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84004030	MN -94cc	9:20562
2	NTIS PC A02/MF A01 (GPO Dep.)	DE84003999	MN -4	9:20438
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84004034	MN -34A	9:21188
CONF-840560-	(31. international technical communication conference, Seattle, WA, USA, 1 May 1984)			
1	*See* UCRL-89704	DE84001004	MN -32	9:21641
CONF-840561-	(17. IEEE photovoltaic specialists conference, Kissimmee, FL, USA, 1-4 May 1984)			
1	*See* SAND-83-1932C	DE84009464	MN -63	9:19915
CONF-840565-	(32. annual North American Bethological Society meeting, Raleigh, NC, USA, 23-25 May 1984)			
1	*See* DP-MS-83-102	DE84005180	MN -11	9:20864
CONF-840576-	(International symposium on circuits and systems - ISCAS'84, Montreal, Canada, 7-10 May 1984)			
15	*See* SAND-84-0317C	DE84006486	MN -38	9:21450
CONF-840577-	(30. international instrumentation symposium, Denver, CO, USA, 7-10 May 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006422	MN -90h	9:19657
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006450	MN -90c	9:19607
4	*See* SAND-83-2507C	DE84009489	MN -70	9:19787
CONF-840578-	(5. international heat pipe conference, Tsukuba, Ibaraki, Japan, 14-18 May 1984)			
1	*See* LA-UR-84-120	DE84006035	MN -38	9:20607
CONF-840579-	(SESA spring meeting, Cleveland, OH, USA, 15-20 May 1984)			
1	*See* SAND-82-1971C	DE84006341	MN -38	9:21153
CONF-8405119-	(Carnahan conference on security technology, Lexington, KY, USA, 16-18 May 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007303	MN -15	9:19831
CONF-8405120-	(SPE/DOE/GRI gas recovery symposium, Pittsburgh, PA, USA, 13-15 May 1984)			
1	*See* SAND-83-2470C	DE84007575	MN -92a	9:19692
2	*See* SAND-84-0543C	DE84008335	MN -92a	9:19687
4	*See* SAND-83-2469C	DE84009095	MN -91	9:19686
5	*See* SAND-83-2448C	DE84009063	MN -92a	9:19691
CONF-8405121-	(Symposium on difficult to plate materials, Ulm, F.R. Germany, 3-4 May 1984)			
1	*See* UCRL-90466	DE84008329	MN -25	9:20457
CONF-8405126-	(4. international conference on distributed computing systems, San Francisco, CA, USA, 14-18 May 1984)			
1	*See* UCRL-89755	DE84008297	MN -32	9:21639

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-8405127-	(25. AIAA/ASME/ASCE/AHE structures, structural dynamics and materials conference, Palm Springs, CA, USA, 14-16 May 1984)			
1	*See* SAND-83-1909C	DE84007888	MN -60	9:19975
2	*See* SAND-83-1889C	DE84008293	MN -38	9:20579
CONF-8405128-	(7. annual conference on automated deduction - CADE 7, Napa, CA, USA, 14-15 May 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009212	MN -32	9:21624
CONF-8405131-	(6. annual ideas in science and engineering exposition and symposium, Albuquerque, NM, USA, 2 May 1984)			
2	*See* LA-UR-84-1120	DE84010001	MN -32	9:21631
CONF-840664-	(9. international congress on metallic corrosion, Toronto, Canada, 3-7 Jun 1984)			
4	*See* Y/DU-336	DE84007663	MN -25	9:20458
CONF-841048-	(Rocky Mountain coal symposium, Bismarck, ND, USA, 2-4 Oct 1984)			
1	*See* DOE/FE/60181-52	DE84009232	MN -90a	9:19631
COO-				
2383-0101	*See* UIUCDCS-R-84-1151	DE84010028	MN -32	9:21640
2383-0102	*See* UIUCDCS-R-83-1154	DE84008487	MN -32	9:21425
CTA-EAV-				
009/ 81	NTIS (US Sales Only), PC A02/MF A01	DE84701037	MN -34A	9:20507
017/ 81	NTIS (US Sales Only), PC A02/MF A01	DE84701001	MN -34D	9:21189
CTA-LEA-				
010/ 81	NTIS (US Sales Only), PC A02/MF A01	DE84701030	MN -34A	9:21190
DASIAC-SR-				
194	*See* AD-A-134721/0			9:20713
DOE/AD/11151-				
T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84009398	MN -98A	9:19665
DOE/BC/10116-				
26	NTIS, PC A19/MF A01 (GPO Dep.)	DE84009783	STD -92a	9:19670
DOE/BC/10188-				
33	NTIS, PC A05/MF A01 (GPO Dep.)	DE84009788	STD -92b	9:19630
DOE/BC/10349-				
1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84008984	STD -92b	9:19674
DOE/BP-				
195	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84010087	MN -60	9:19966
225	NTIS, PC A05/MF A01 (GPO Dep.)	DE84010094	MN -97e	9:19895
228	NTIS, PC A; 3 (GPO Dep.)	DE84009034	MN -95f	9:20399
DOE/CE-				
0078	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84010084	STD -25	9:20430
DOE/CE/15095-				
13	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009730	STD -61E	9:19870
DOE/CE/15151-				
T1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84010080	MN -95	9:20354
T2	NTIS, PC A08/MF A01 (GPO Dep.)	DE84010082	MN -95	9:20355
T3	NTIS, PC A07/MF A01 (GPO Dep.)	DE84010081	MN -95	9:20356
DOE/CE/23861-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009896	MN -95d	9:20361
T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84009346	MN -95d	9:20362
T3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009895	MN -95d	9:20363
DOE/CE/40558-				
T1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009368	STD -95f	9:20400
DOE/CE/64835-				
1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009358	STD -95d	9:20364
DOE/CS/02849-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009455	MN -90	9:19977
DOE/CS/15058-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009365	MN -95f	9:20401
DOE/CS/20002-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009220	MN -61	9:19882
DOE/CS/20245-				
T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84009518	MN -95e	9:20418
DOE/CS/20262-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009362	MN -95a	9:20329
DOE/CS/20271-				
1	NTIS, PC A07; 3 (GPO Dep.)	DE84009371	MN -95d	9:20365
DOE/CS/20327-				
T1	NTIS, PC A19/MF A01; 1 (GPO Dep.)	DE84009426	MN -95d	9:20366
DOE/CS/20529-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009476	MN -95d	9:20367
T2	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84009521	MN -95d	9:20368
T3	NTIS, PC A99; 3 (GPO Dep.)	DE84009960	MN -95d	9:20369
T4	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE84009453	MN -95d	9:20370
DOE/CS/30241-				
1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84009341	MN -95d	9:20371
DOE/CS/30344-				
2	NTIS, PC A06; 3 (GPO Dep.)	DE84006570	MN -59a	9:19942
DOE/CS/40175-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009425	MN -95f	9:20402
DOE/CS/40229-				
T1	NTIS, PC A21/MF A01; 1 (GPO Dep.)	DE84009167	MN -95f	9:20403
DOE/CS/50003-				
1	NTIS, PC A09; 3 (GPO Dep.)	DE84008907	STD -96	9:20426

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DOE/CS/54270-T1	NTIS, PC A02; 3 (GPO Dep.)	DE84010020	MN -96	9:20425
DOE/CS/60204-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009931	MN -95d	9:20372
DOE/CS/60490-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007862	MN -95d	9:20373
DOE/CS/69031-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009364	MN -95	9:20424
DOE/DP/40124-21	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008381	MN -21	9:20598
DOE/EI/10323-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84010149	MN -98B	9:19676
DOE/EIA-0035(83/ 12[4])	NTIS, PC A06/MF A01 - GPO (GPO Dep.)	DE84010030	MN -98	9:19677
0109(84/ 01)	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84009978	MN -98B	9:19678
0130(84/ 01)	NTIS, PC A06/MF A01 - GPO (GPO Dep.)	DE84009503	MN -98B	9:19689
0435	NTIS, PC A09/MF A01 - GPO (GPO Dep.)	DE84010036	MN -98B	9:19667
DOE/ER-0132/ 1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008873	STD -20	9:21456
DOE/ER/03158-117	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009142	MN -25	9:20439
DOE/ER/03992-538	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009147	MN -34D	9:21226
539	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009091	MN -34D	9:21227
DOE/ER/04445-T4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007966	MN -94cc	9:20563
DOE/ER/05001-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007251	MN -28	9:20625
DOE/ER/05126-207	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008018	MN -34D	9:21358
DOE/ER/10108-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007679	MN -70	9:19772
T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010219	MN -70	9:19773
T3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84010215	MN -70	9:19774
DOE/ER/10377-6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010216	MN -4	9:20538
DOE/ER/10418-T4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008349	MN -34C	9:21271
DOE/ER/10459-46	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010029	MN -34	9:21421
DOE/ER/10492-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008048	MN -93	9:20351
DOE/ER/10505-T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008352	MN -4	9:20578
DOE/ER/10512-4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009675	MN -34A	9:21191
DOE/ER/10546-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006730	MN -61G	9:19902
DOE/ER/10629-T1	NTIS, PC A05; 3 (GPO Dep.)	DE84008350	MN -34D	9:20674
DOE/ER/10710-4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008353	MN -34C	9:21337
DOE/ER/10720-14	NTIS, PC A02; 3 (GPO Dep.)	DE84009146	MN -92	9:19871
DOE/ER/10774-4	NTIS, PC A02; 3 (GPO Dep.)	DE84010027	MN -34B	9:21166
DOE/ER/10880-T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009344	MN -48	9:19872
DOE/ER/10896-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007406	MN -25	9:20508
DOE/ER/10972-T2	NTIS, PC A04/MF A01 (GPO Dep.)	DE83017203	MN -25	9:20440
DOE/ER/10978-4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008273	MN -34	9:20509
DOE/ER/12081-5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009447	MN -34A	9:21192
DOE/ER/13098-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010124	MN -34A	9:21193
DOE/ER/13102-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009423	MN -4	9:20564
DOE/ER/30042-T1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009045	STD -70	9:19775
DOE/ER/40008-56	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007289	MN -34D	9:21243
DOE/ER/40036-3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010037	MN -34D	9:21214
DOE/ER/40039-7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007463	MN -34D	9:20675
DOE/ER/53113-T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008573	STD -20	9:21460
DOE/ER/53150-T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009054	MN -20g	9:21461
DOE/ER/60104-3	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84009850	MN -11	9:20758

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DOE/ET/10069-T87	NTIS (US Sales Only), PC A06/MF A01; 1 (GPO Dep.)	DE84010251	STD -90d	9:19608
DOE/ET/10159-1552	NTIS, PC A11/MF A01 (GPO Dep.)	DE84003066	STD -90c	9:19609
DOE/ET/10723-1545	NTIS, PC A08/MF A01 (GPO Dep.)	DE84003077	STD -90c	9:19648
DOE/ET/10815-74	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008052	STD -90g	9:20348
88	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008283	STD -90g	9:20349
DOE/ET/12178-T1	NTIS MF A01; 2 (GPO Dep.)	DE84009375	MN -96	9:20427
DOE/ET/13114-T8	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009427	MN -93	9:20352
DOE/ET/13376-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009345	MN -90d	9:19873
DOE/ET/15611-15	NTIS, PC A07/MF A01 (GPO Dep.)	DE84007690	MN -90g	9:20350
DOE/ET/20330-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84006677	MN -64	9:19929
DOE/ET/20544-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009522	MN -63	9:19903
DOE/ET/27125-T2-Vol.3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008042	MN -66a	9:19962
T2-Vol.6	NTIS, PC A05/MF A01 (GPO Dep.)	DE84008039	MN -66a	9:19960
T4-Vol.2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84008037	MN -66a	9:19963
DOE/ET/28495-T1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009520	MN -66	9:19959
DOE/ET/34019-3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010228	STD -78	9:20007
DOE/ET/37873-1-Pt.1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84000904	MN -32	9:21625
DOE/ET/53051-62	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84009659	STD -20f	9:21462
DOE/ET/53055-T2	NTIS, PC A07/MF A01 (GPO Dep.)	DE84009366	MN -20a	9:21463
DOE/ET/53136-7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009139	MN -20g	9:21470
DOE/EV-0005-46	NTIS, PC A06/MF A01 (GPO Dep.)	DE84009123	STD -70A	9:20143
DOE/EV/00902-35	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE84010113	MN -11	9:21159
DOE/EV/01332-1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007318	MN -11	9:20815
DOE/EV/10098-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010253	MN -11	9:20720
DOE/EV/10782-T1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84007528	MN -80	9:20144
DOE/FE/00016-T24	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009196	MN -88	9:19653
DOE/FE/60181-52	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009232	MN -90a	9:19631
82	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009350	MN -90i	9:19635
83	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009349	MN -90i	9:19636
DOE/ID/01809-T1	NTIS, PC A08/MF A01 (GPO Dep.)	DE84006089	MN -97a	9:20338
DOE/ID/12163-1	NTIS MF A01; 2 (GPO Dep.)	DE84008535	MN -95e	9:20419
DOE/IR/01691-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007902	MN -95c	9:20374
T2	NTIS, PC A08; 3 (GPO Dep.)	DE84007935	MN -95	9:20375
DOE/JPL/955392-2	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84010158	STD -63b	9:19904
DOE/JPL/955688-82/ 10	NTIS, PC A07/MF A01 (GPO Dep.)	DE84008241	STD -63b	9:19905
DOE/JPL/956046-83/ 9	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009494	STD -63b	9:19906
DOE/LC/10678-1563	NTIS, PC A03/MF A01 (GPO Dep.)	DE84003088	STD -91	9:19715
DOE/LC/10686-T1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84006468	STD -91	9:19716
DOE/LC/10886-1555	NTIS, PC A07/MF A01 (GPO Dep.)	DE84003086	STD -90c	9:20603
DOE/MA-0139/ 1	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84009897	MN -13	9:21620
DOE/MC/14603-1562	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84007583	STD -90b	9:19659
DOE/MC/16015-1368-Vol.2	NTIS, PC A17/MF A01	DE83007256	MN -92a	9:19690
DOE/MC/16049-1558-Vol.1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84003090	STD -90c	9:19982
1558-Vol.2	NTIS, PC A05/MF A01 (GPO Dep.)	DE84003091	STD -90c	9:19983
DOE/MC/16359-1521	NTIS, PC A08/MF A01; 1	DE84004863	STD -90i	9:19637
DOE/MC/16472-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009913	MN -90a	9:20699

Report No.	Availability	Order No.	Distribution Category	Abstract No.
DOE/MC/16518-1476	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84008275	STD -90c	9:19610
DOE/MC/19077-1532	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84003067	STD -90c	9:19611
DOE/MC/19239-1546	NTIS, PC A11/MF A01 (GPO Dep.)	DE84003080	STD -92	9:19693
DOE/MC/19299-1564	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84007356	STD -90b	9:19660
DOE/MC/19404-T14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009302	MN -92a	9:19654
DOE/METC-84-7	NTIS, PC A24/MF A01; 1 (GPO Dep.)	DE84003052	STD -90c	9:19612
84-8	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84000217	STD -90c	9:19613
DOE/MI/10001-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009458	MN -13	9:20376
DOE/NBB-0053	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84009664	STD -11	9:20724
DOE/NBM-4001796	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84001796	MN -38	9:20613
4006922	NTIS, PC A06/MF A01 (GPO Dep.)	DE84006922	MN -59a	9:19943
4007520	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007520	MN -20a	9:21541
4007527	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007527	MN -11	9:20725
4007536	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007536	MN -20a	9:21542
4007543	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007543	MN -86	9:19730
4009153	NTIS, PC A02; 3 (GPO Dep.)	DE84009153	MN -20c	9:21543
4009183	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84009183	MN -96	9:20397
4009554	NTIS, PC A05/MF A01 (GPO Dep.)	DE84009554	MN -25	9:20431
DOE/NOAA/OTEC-100-2	*See* PB-83-223586		MN -64	9:19936
DOE/NV/10162-14	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84010238	MN -11	9:20761
DOE/NV/10282-T4	NTIS, PC A08/MF A01 (GPO Dep.)	DE84009317	MN -70	9:19776
T5	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84009316	MN -70	9:19777
DOE/NV/10327-5	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009729	MN -41	9:20145
DOE/OR/03054-21	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84009919	STD -89	9:19614
85	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84010110	STD -89	9:19615
86	NTIS, PC A06/MF A01 (GPO Dep.)	DE84009435	STD -89	9:19616
DOE/OR/21400-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010033	MN -93	9:20353
DOE/PC/30231-T5-Vol.1	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84007948	STD -90i	9:19638
T5-Vol.2	NTIS, PC A08/MF A01 (GPO Dep.)	DE84007949	STD -90i	9:19639
DOE/PC/30233-T4	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84008300	STD -90i	9:19640
DOE/PC/30265-T1	NTIS, PC A06/MF A01	DE84004643	STD -90d	9:19883
DOE/PC/40807-T9	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84010077	MN -90a	9:19661
DOE/PC/40812-T10	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008311	MN -90a	9:19617
DOE/PC/50796-T4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008378	MN -90a	9:20604
DOE/PC/51255-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007304	STD -90d	9:20539
DOE/PC/60015-9	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007386	STD -90d	9:20540
DOE/PC/60266-T2	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009312	STD -90i	9:19641
DOE/PC/60785-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008274	MN -90a	9:19632
DOE/PC/60803-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007678	MN -90a	9:19633
DOE/R5/10302-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007971	MN -95e	9:20404
DOE/R5/10318-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009100	MN -95e	9:20377
DOE/R7/01000-T1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007808	MN -61A	9:19907
DOE/R7/01001-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007765	MN -95d	9:20378
DOE/R7/01010-T1	NTIS, PC A04; 3 (GPO Dep.)	DE84007756	MN -59	9:19944
DOE/R7/01014-T1	NTIS, PC A03; 3 (GPO Dep.)	DE84007753	MN -95d	9:20379
DOE/R7/01022-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007752	MN -95e	9:20420
DOE/R7/01038-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007738	MN -95d	9:20380
DOE/R7/01039-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007739	MN -95d	9:20381
DOE/R7/01135-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007861	MN -95	9:20382

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DOE/R7/01136-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007858	MN -95	9:20405
DOE/R7/01140-T1	NTIS, PC A03; 3 (GPO Dep.)	DE84007859	MN -96	9:20428
DOE/R7/01145-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007854	MN -95d	9:20383
DOE/R7/01160-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010012	MN -61	9:19884
DOE/R7/01164-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010009	MN -63	9:19922
DOE/R7/01169-T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84010007	MN -95	9:20406
DOE/R7/01171-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84010003	MN -61F	9:19885
DOE/R7/01176-T1	NTIS, PC A02; 3 (GPO Dep.)	DE84010093	MN -60	9:19967
DOE/R7/01203-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84006076	MN -59c	9:19945
DOE/R7/01204-T1	NTIS, PC A03; 3 (GPO Dep.)	DE84010098	MN -95d	9:20384
DOE/R7/01207-T1	NTIS, PC A02; 3 (GPO Dep.)	DE84010097	MN -60	9:19968
DOE/R7/01213-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009761	MN -61F	9:19908
DOE/R7/01219-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84009762	MN -60	9:19969
DOE/R7/01221-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009758	MN -60	9:19970
T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009756	MN -60	9:19971
T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009757	MN -60	9:19972
T4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009759	MN -60	9:19973
DOE/RG/06390-T1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84009367	MN -98E	9:20330
DOE/RG/06598-T1	NTIS, PC A14; 3 (GPO Dep.)	DE84008344	MN -13	9:19683
DOE/RG/06624-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84010165	MN -98B	9:19679
DOE/SF/10501-306	NTIS, PC A03/MF A01 (GPO Dep.)	DE84006965	MN -62	9:19899
DOE/SF/11676-T1	NTIS, PC A21/MF A01; 1 (GPO Dep.)	DE84006459	MN -62d	9:19925
DOE/SF/11686-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007422	MN -95	9:20346
DOE/SW/13008-T1	NTIS, PC A05/MF A01 (GPO Dep.)	DE84009459	MN -11	9:19896
DOE/UMT-0214	NTIS, PC A07/MF A01 (GPO Dep.)	DE84010103	MN -70	9:19778
DP-1670	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010096	STD -4	9:20041
1675	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008533	STD -11	9:20731
DP-MS-83-85	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008301	MN -80	9:19857
83-102	NTIS, PC A03/MF A01 (GPO Dep.)	DE84005180	MN -11	9:20864
84-16	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009078	MN -41	9:19827
84-29	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010151	MN -48	9:21098
DPST-80-129-6	NTIS, PC A02/MF A01; 1	DE84009026	MN -23	9:19858
81-133-1	NTIS, PC A03/MF A01; 1	DE84007711	MN -23	9:19859
82-133-1	NTIS, PC A03/MF A01; 1	DE84009006	MN -23	9:19860
83-133-1	NTIS, PC A02/MF A01; 1	DE84009004	MN -23	9:19861
EAS-G-4	International Energy Agency Coal Research, London (UK). Economic Assessment Service			9:19666
EEB-L-83-08	*See* LBL-15382	DE84009238	MN -95d	9:20387
EEB-Vent-83-6	*See* LBL-15878-Rev.	DE84009243	MN -41	9:20721
EFI-566(53) -82	NTIS (US Sales Only), PC A02/MF A01	DE84700781	MN -28	9:20639
EGG-2303	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009490	MN -78	9:20146
10282-1001	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009667	STD -41	9:20762
10282-1026	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009670	STD -41	9:20763
10282-2012	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007584	MN -28	9:20626
10282-2013	NTIS, PC A02/MF A01 (GPO Dep.)	DE84005034	MN -28	9:20627
EGG-M-10783	NTIS, PC A02; 3 (GPO Dep.)	DE84005053	MN -20	9:21544
12583	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007664	MN -78	9:20079
14083	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007665	MN -78	9:20080
EML-421	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009787	STD -11	9:20764
424	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84009313	STD -11	9:20765
EPA-450/ 3-84-002	NTIS, PC A03/MF A01		MN -11	9:20755
450/ 3-84-003	NTIS, PC A04/MF A01		MN -11	9:20756

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EPA-SW-				
963-Rev.	NTIS, PC A09/MF A01; 1	DE84900827	MN -11	9:20819
EPRI-AP-				
2844-Vol.2	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -90c	9:19618
3285-Vol.1	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -62	9:19926
EPRI-CS-				
3122-Vol.1	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -90i	9:19642
3354-Vol.1	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -90i	9:19643
3354-Vol.2	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -90i	9:19644
3374-Vol.1	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -90b	9:19662
3413-Vol.1	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -90b	9:19663
3413-Vol.2	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -90b	9:19664
EPRI-EA-				
3064	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -11	9:20726
3076	Research Report Center, Box 50490, Palo Alto, CA 94303		ND -11	9:20727
3409	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -95	9:20385
3410	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -95d	9:20386
EPRI-EL-				
3358	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -97e	9:19978
EPRI-EM-				
3227	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -97b	9:20339
3424-Vol.4	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -92a	9:19671
EPRI-NP-				
2106	EPRI, Research Report Center, Box 50490, Palo Alto, CA 94303		ND -78	9:19991
2107	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:19992
2377	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:20147
3222	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -70B	9:19779
3302	EPRI, Research Reports Center (RRC), Box 50490, Palo Alto, CA 94303		ND -78	9:20008
3311	EPRI, Research Reports Center (RRC), Box 50490, Palo Alto, CA 94303		ND -78	9:19979
3323	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:20050
3341	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -80	9:19980
3357	EPRI, Research Reports Center (RRC), Box 50490, Palo Alto, CA 94303		ND -80	9:20042
3365	Research Report Center, Box 50490, Palo Alto, CA 94303		ND -85	9:19736
3394-CCM-Vol.1	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:20009
3394-CCM-Vol.2	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -80	9:20010
3394-CCM-Vol.3	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:20011
3394-CCM-Vol.4	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:20012
3411	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:20148
3418	NTIS, PC A04/MF A01 - EPRI (GPO Dep.)	DE84009306	MN -78	9:20034
3419	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:20051
3432	EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -78	9:20013
EUR-				
8035-EN	*See* PB-84-137272			9:20335
8057	NTIS (US Sales Only), PC A06/MF A01	DE84700778	MN -71	9:20580
8145-FR	*See* PB-84-138270			9:19913
8155-DE	*See* PB-84-138932			9:19914
8157-EN	*See* PB-84-137306			9:19912
8217-EN	*See* PB-84-137280			9:19911
8241/ 11-FR	*See* PB-84-137348			9:19949
8241-EN	*See* PB-84-137330			9:19948
8251	NTIS (US Sales Only), PC A09/MF A01	DE84700761	MN -41	9:19818
8292-EN	*See* PB-84-136563			9:20307
8459-EN	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:20306

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8508-DE	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:19619
8639-EN/ IT	European Community Information Service, 2100 M St., NW, Washington, DC 20037		ND -96	9:20441
FE-				
2893-113	*See* DOE/ET/10069-T87	DE84010251	STD -90d	9:19608
FEI-				
1249	NTIS (US Sales Only), PC A02/MF A01	DE84700746	MN -25	9:19726
1285	NTIS (US Sales Only), PC A02/MF A01	DE84700738	MN -25	9:20442
1317	NTIS (US Sales Only), PC A02/MF A01	DE84700774	MN -38	9:20605
1375	NTIS (US Sales Only), PC A02/MF A01	DE84700775	MN -38	9:20043
FERC/EIS-				
0005	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE84009442	MN -11	9:20868
0011	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84009439	MN -11	9:20869
0013	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84009440	MN -11	9:19646
0015	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84009436	MN -11	9:20870
0016	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84009437	MN -92b	9:19682
0023	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84009434	MN -97e	9:19897
0026	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84009342	MN -97e	9:19898
FERMILAB/TM-				
1238	NTIS, PC A05; 3 (GPO Dep.)	DE84009412	MN -28	9:20640
1239	NTIS, PC A02; 3 (GPO Dep.)	DE84009404	MN -34D	9:20621
1240	NTIS, PC A02; 1 (GPO Dep.)	DE84009403	MN -28	9:20641
1241	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009408	MN -28	9:20628
1242	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009407	MN -2	9:20642
1243	NTIS, PC A02; 3 (GPO Dep.)	DE84009406	MN -28	9:20643
1244	NTIS, PC A02; 3 (GPO Dep.)	DE84009411	MN -28	9:20644
1245	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009866	MN -38	9:20581
1246	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009867	MN -28	9:20629
1247	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009862	MN -28	9:20630
FPC-R-				
87	NTIS, PC A03/MF A01; 1 - GPO $0.75	DE84900756	MN -98E	9:20340
FRNC-TH-				
1336	NTIS (US Sales Only), PC A10; 3	DE84751043	MN -63	9:19909
FWS/OBS-				
81/ 09	NTIS, PC A03/MF A01	DE84900909	MN -88	9:19655
83/ 14-Vol.1	US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458		MN -11	9:20308
83/ 14-Vol.2-Pt.1	US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458		MN -11	9:20314
83/ 14-Vol.2-Pt.2	US Fish and Wildlife, NCET, 1010 Gause Blvd., Slidell, LA 70458		MN -11	9:20315
83/ 14-Vol.2-Pt.3-App.	US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458		MN -11	9:20316
83/ 15-Vol.1	US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458		MN -11	9:20309
83/ 15-Vol.2-Pt.1	US Fish and Wildlife Service, NCET, 1010 Gause Blvd., Slidell, LA 70458		MN -11	9:20317
FXM-				
881	NTIS, PC A02; 3 (GPO Dep.)	DE84007623	MN -33	9:20129
884	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007622	MN -33	9:20130
909	NTIS, PC A02; 3 (GPO Dep.)	DE84007627	MN -33	9:20131
917	NTIS, PC A02; 3 (GPO Dep.)	DE84007626	MN -33	9:20132
922-Suppl.1	NTIS, PC A02; 3 (GPO Dep.)	DE84007614	MN -33	9:21626
931	NTIS, PC A02; 3 (GPO Dep.)	DE84007618	MN -33	9:20149
978	NTIS, PC A02; 3 (GPO Dep.)	DE84007628	MN -33	9:20133
1002	NTIS, PC A02; 3 (GPO Dep.)	DE84007631	MN -33	9:20134
1011	NTIS, PC A02; 3 (GPO Dep.)	DE84007635	MN -33	9:20135
1014	NTIS, PC A02; 3 (GPO Dep.)	DE84007634	MN -33	9:20136
6825	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007045	MN -33	9:20081
7228-Suppl.1	NTIS, PC A02/MF A01; 3 (GPO Dep.)	DE84007077	MN -33	9:20137
GA-				
A17325	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009092	MN -20a	9:21545
GA-A-				
17076	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009384	STD -20g	9:21471
17174	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009018	MN -20d	9:21546
17212	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009039	MN -20d	9:21547
17214	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009020	MN -20d	9:21472
17373	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009666	STD -20	9:21548
17375	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009472	MN -20a	9:21549
17426	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009138	MN -90e	9:20618
17450	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007292	MN -20a	9:21473
17503	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009400	MN -20a	9:21474
GEAP-				
22049	*See* EPRI-NP-2377		ND -78	9:20147
GEFR-				
00681	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84009041	STD -77	9:20020
GEPP-OP-				
754a	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008021	MN -13	9:21627
HEDL-				
7365	NTIS, PC A03/MF A01 (GPO Dep.)	DE84010256	MN -41	9:21099
7368	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010258	MN -32	9:21628
7372	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009501	MN -20c	9:20496
7436	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008506	MN -20c	9:21550
7437	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008181	MN -20c	9:21551

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HEDL-SA-				
2841	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84003949	MN -80	9:20150
2892-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84003952	MN -79	9:19727
IAE-				
3586/ 5	NTIS (US Sales Only), PC A04/MF A01	DE84700762	MN -41	9:20151
3604/ 11	NTIS (US Sales Only), PC A02/MF A01	DE84700747	MN -25	9:21554
3610/ 10	NTIS (US Sales Only), PC A02/MF A01	DE84700739	MN -25	9:20443
IAEA-R-				
1825-F	NTIS (US Sales Only), PC A02/MF A01	DE84700766	MN -41	9:20823
2234-F	NTIS (US Sales Only), PC A05/MF A01	DE84700752	MN -11	9:20824
2493-F	NTIS (US Sales Only), PC A03/MF A01	DE84700753	MN -11	9:20825
2596-F	NTIS (US Sales Only), PC A02/MF A01	DE84700757	MN -48	9:20941
2634-F	NTIS (US Sales Only), PC A08/MF A01	DE84700767	MN -41	9:21100
2742-F	NTIS (US Sales Only), PC A03/MF A01	DE84700758	MN -23	9:21101
3088-F	NTIS (US Sales Only), PC A02/MF A01	DE84700768	MN -41	9:21409
3094-F	NTIS (US Sales Only), PC A02/MF A01	DE84700754	MN -11	9:20826
IAEA-RL-				
101	NTIS (US Sales Only), PC A03/MF A01	DE84700730	MN -4	9:20541
102	NTIS (US Sales Only), PC A03/MF A01	DE84700731	MN -4	9:20542
103	NTIS (US Sales Only), PC A02/MF A01	DE84700760	MN -23	9:20543
104	NTIS (US Sales Only), PC A03/MF A01	DE84700732	MN -4	9:20544
IAEA-TECDOC-				
274	NTIS (US Sales Only), PC A06/MF A01	DE84700755	MN -11	9:20827
294	NTIS (US Sales Only), PC A12/MF A01	DE84700763	MN -41	9:20152
IC-				
82/ 216	NTIS (US Sales Only), PC A03/MF A01	DE84701073	MN -34D	9:21215
IFT-C-				
01/ 82	NTIS (US Sales Only), PC A16/MF A01	DE84701065	MN -34D	9:21212
IFT-P-				
01/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701057	MN -34B	9:21167
03/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84701031	MN -34A	9:21432
04/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701079	MN -34C	9:21359
06/ 82	*See* IFUSP-P-333	DE84701066	MN -34D	9:21228
07/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84701053	MN -34B	9:21168
08/ 82	*See* IFUSP-P-336	DE84701082	MN -34C	9:21362
09/ 82	*See* IFUSP-P-345	DE84701068	MN -34D	9:21229
10/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701027	MN -34D	9:21244
14/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701021	MN -34D	9:21433
15/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701058	MN -34B	9:21169
17/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84701022	MN -34D	9:21434
18/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701023	MN -34D	9:21435
IFT-T-				
05/ 82	NTIS (US Sales Only), PC A07/MF A01	DE84701032	MN -34A	9:21216
IFUSP-P-				
315	NTIS (US Sales Only), PC A03/MF A01	DE84701049	MN -20	9:21206
317	NTIS (US Sales Only), PC A02/MF A01	DE84701002	MN -34D	9:21449
318	NTIS (US Sales Only), PC A03/MF A01	DE84701003	MN -34D	9:21245
320	NTIS (US Sales Only), PC A02/MF A01	DE84701038	MN -34A	9:21422
321	NTIS (US Sales Only), PC A02/MF A01	DE84701075	MN -46	9:21360
327	NTIS (US Sales Only), PC A02/MF A01	DE84701080	MN -34C	9:21293
329	NTIS (US Sales Only), PC A02/MF A01	DE84701004	MN -34D	9:21436
330	NTIS (US Sales Only), PC A03/MF A01	DE84701039	MN -34A	9:21423
331	NTIS (US Sales Only), PC A03/MF A01	DE84701005	MN -34D	9:21246
332	NTIS (US Sales Only), PC A02/MF A01	DE84701081	MN -34C	9:21361
333	NTIS (US Sales Only), PC A02/MF A01	DE84701066	MN -34D	9:21228
334	NTIS (US Sales Only), PC A02/MF A01	DE84701040	MN -34A	9:20510
336	NTIS (US Sales Only), PC A02/MF A01	DE84701082	MN -34C	9:21362
337	NTIS (US Sales Only), PC A02/MF A01	DE84701083	MN -34C	9:21437
338	NTIS (US Sales Only), PC A03/MF A01	DE84701084	MN -34C	9:21307
339	NTIS (US Sales Only), PC A02/MF A01	DE84701041	MN -34A	9:20511
341	NTIS (US Sales Only), PC A02/MF A01	DE84701033	MN -34A	9:21316
342	NTIS (US Sales Only), PC A02/MF A01	DE84701059	MN -34B	9:21170
344	NTIS (US Sales Only), PC A03/MF A01	DE84701006	MN -34D	9:21438
345	NTIS (US Sales Only), PC A03/MF A01	DE84701068	MN -34D	9:21229
346	NTIS (US Sales Only), PC A02/MF A01	DE84701007	MN -34D	9:21277
348	NTIS (US Sales Only), PC A02/MF A01	DE84701008	MN -34D	9:21247
350	NTIS (US Sales Only), PC A02/MF A01	DE84701087	MN -34C	9:21363
355	NTIS (US Sales Only), PC A03/MF A01	DE84701047	MN -34A	9:20512
360	NTIS (US Sales Only), PC A02/MF A01	DE84701026	MN -34D	9:21230
363	NTIS (US Sales Only), PC A02/MF A01	DE84701069	MN -34D	9:21231
IFVE-OEF-				
82-197	NTIS (US Sales Only), PC A02/MF A01	DE84700782	MN -28	9:20645
IFVE-OI-				
82-179	NTIS (US Sales Only), PC A02/MF A01	DE84700783	MN -28	9:20631
IFVE-OUNK-				
82-158	NTIS (US Sales Only), PC A02/MF A01	DE84700776	MN -38	9:20582
IHEP-HD-				
83-1	Library of Heidelberg Univ. (Germany, F.R.)			9:21217
INDC(EUR)-				
017-G	*See* NEANDC(E)-242-U(Vol.3)	DE84700726	MN -34C	9:21406
INDC(JAP)-				
73-L	*See* NEANDC(J)-86-U	DE84700728	MN -34C	9:21354
INIS-mf-				
8304	NTIS (US Sales Only), PC A10/MF A01	DE84780116	MN -34C	9:21312
8309	NTIS (US Sales Only), PC A06/MF A01	DE84780117	MN -34C	9:21294

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8324	NTIS (US Sales Only), PC A08/MF A01	DE84780118	MN -34C	9:21272
8696	NTIS (US Sales Only), PC A08/MF A01	DE84780102	MN -34D	9:21439
8703	NTIS (US Sales Only), PC A08/MF A01	DE84780103	MN -34D	9:21270
INIS-SU-				
197	NTIS (US Sales Only), PC A06/MF A01	DE84780108	MN -34A	9:20444
198	NTIS (US Sales Only), PC A99/MF A01	DE84780104	MN -34D	9:21273
INPE-				
2321	NTIS (US Sales Only), PC A02/MF A01	DE84701050	MN -20	9:21207
2333	NTIS (US Sales Only), PC A06/MF A01	DE84701063	MN -34B	9:21171
2371	NTIS (US Sales Only), PC A04/MF A01	DE84701064	MN -34B	9:21172
2416	NTIS (US Sales Only), PC A03/MF A01	DE84701051	MN -20	9:21181
2483	NTIS (US Sales Only), PC A02/MF A01	DE84701055	MN -34B	9:21173
INR-				
483/ 2	NTIS (US Sales Only), PC A02; 3	DE84900980	MN -34	9:20445
510/ 14	NTIS (US Sales Only), PC A02; 3	DE84901024	MN -4	9:20446
513/ 2	NTIS (US Sales Only), PC A02; 3	DE84901027	MN -4	9:20513
524/ 16	NTIS (US Sales Only), PC A02; 3	DE84901026	MN -4	9:20447
529/ 18	NTIS (US Sales Only), PC A02; 3	DE84901028	MN -34	9:21475
544/ 9	NTIS (US Sales Only), PC A02; 3	DE84901005	MN -80	9:20014
549/ 17	NTIS (US Sales Only), PC A02; 3	DE84901000	MN -4	9:20567
613/ 9A/ PR	NTIS (US Sales Only), PC A02; 3	DE84901002	MN -34	9:21476
615/ 9-A/ R	NTIS (US Sales Only), PC A02; 3	DE84901003	MN -34C	9:21404
722/ 2/ PL	NTIS (US Sales Only), PC A02; 3	DE84901007	MN -4	9:20448
845/ 7/ PL	NTIS (US Sales Only), PC A02; 3	DE84901008	MN -20f	9:21477
INS-J-				
165	NTIS (US Sales Only), PC A03/MF A01	DE84700784	MN -28	9:20646
INS-NUMA-				
29	NTIS (US Sales Only), PC A08/MF A01	DE84780112	MN -34C	9:21405
31	NTIS (US Sales Only), PC A06/MF A01	DE84780113	MN -34C	9:20622
41	NTIS (US Sales Only), PC A02/MF A01	DE84700785	MN -28	9:20655
INS-TH-				
148	NTIS (US Sales Only), PC A02/MF A01	DE84700786	MN -28	9:20662
149	NTIS (US Sales Only), PC A02/MF A01	DE84700787	MN -28	9:20656
INS-TS-				
21	NTIS (US Sales Only), PC A02/MF A01	DE84700769	MN -41	9:21413
IPPJ-				
551	NTIS (US Sales Only), PC A11/MF A01	DE84780099	MN -25	9:21555
IPPJ-DT-				
97	NTIS (US Sales Only), PC A06/MF A01	DE84700788	MN -28	9:20657
IS-T-				
1065	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84007204	MN -80	9:20044
ITEF-				
118(1982)	NTIS (US Sales Only), PC A02/MF A01	DE84700740	MN -25	9:20449
119(1982)	NTIS (US Sales Only), PC A02/MF A01	DE84700741	MN -25	9:20450
JAERI-				
1280	NTIS (US Sales Only), PC A12/MF A01	DE84700717	MN -34C	9:21556
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82-117	NTIS (US Sales Only), PC A04/MF A01	DE84700718	MN -34C	9:21302
82-123	NTIS (US Sales Only), PC A03/MF A01	DE84700719	MN -34C	9:21557
82-168	NTIS (US Sales Only), PC A03/MF A01	DE84700770	MN -41	9:20153
82-169	NTIS (US Sales Only), PC A07/MF A01	DE84700734	MN -4	9:20572
82-184	NTIS (US Sales Only), PC A04/MF A01	DE84700764	MN -41	9:20154
82-193	NTIS (US Sales Only), PC A04/MF A01	DE84700789	MN -28	9:20676
82-194	NTIS (US Sales Only), PC A04/MF A01	DE84700743	MN -25	9:21558
82-196	NTIS (US Sales Only), PC A03/MF A01	DE84700742	MN -25	9:20451
82-201	NTIS (US Sales Only), PC A04/MF A01	DE84700779	MN -71	9:20583
82-202	NTIS (US Sales Only), PC A04/MF A01	DE84700780	MN -71	9:20015
82-206	NTIS (US Sales Only), PC A05/MF A01	DE84700748	MN -25	9:20514
82-215	NTIS (US Sales Only), PC A06/MF A01	DE84700765	MN -41	9:21140
83-006	NTIS (US Sales Only), PC A03/MF A01	DE84700720	MN -34C	9:21291
83-021	NTIS (US Sales Only), PC A03/MF A01	DE84700735	MN -25	9:20452
JHU/APL-AEO-				
81-122	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84005601	MN -64	9:19930
JHU/APL-OQR-				
82-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84005671	MN -64	9:19931
82-2	NTIS, PC A03/MF A01 (GPO Dep.)	DE84003369	MN -64	9:19932
82-3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84005603	MN -64	9:19933
82-4	NTIS, PC A03/MF A01 (GPO Dep.)	DE84005602	MN -64	9:19934
83-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84005200	MN -64	9:19935
JINR-				
R-9-82-565	NTIS (US Sales Only), PC A02/MF A01	DE84700791	MN -28	9:20658
R-9-82-573	NTIS (US Sales Only), PC A02/MF A01	DE84700792	MN -28	9:20659
R-13-82-780	NTIS (US Sales Only), PC A02/MF A01	DE84700790	MN -28	9:20632
JINR-D-				
1-82-921	NTIS (US Sales Only), PC A02/MF A01	DE84700721	MN -34C	9:21219
JINR-R-				
1-82-508	NTIS (US Sales Only), PC A02/MF A01	DE84700722	MN -34C	9:21220
K/CSD/TM-				
55	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007681	MN -41	9:19828
K-L-				
6215	NTIS, PC A03/MF A01 (GPO Dep.)	DE84010038	MN -2	9:20606
K/TS-				
11-111	NTIS, PC A02; 3 (GPO Dep.)	DE84005066	MN -34	9:21208
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81-8	NTIS (US Sales Only), PC A08/MF A01	DE84780148	MN -28	9:20660

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81-12	NTIS (US Sales Only), PC A04/MF A01	DE84780111	MN -34D	9:21221
81-16	NTIS (US Sales Only), PC A05/MF A01	DE84780098	MN -34A	9:21198
81-23	NTIS (US Sales Only), PC A05/MF A01	DE84780110	MN -34D	9:21274
KFK-				
3551	NTIS (US Sales Only), MF A01; 2	DE84750728	MN -95	9:20619
KFKI-				
1983-77	NTIS (US Sales Only), PC A02/MF A01	DE84701060	MN -34B	9:21174
KHM-TR-				
86	NTIS (US Sales Only), PC A05/MF A01	DE84700751	MN -51	9:20733
KURRI-TR-				
217	NTIS (US Sales Only), PC A04/MF A01	DE84780100	MN -25	9:20515
219	NTIS (US Sales Only), PC A03/MF A01	DE84780149	MN -80	9:20045
227	NTIS (US Sales Only), PC A02/MF A01	DE84700723	MN -34C	9:21303
LA-				
9903-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84004478	STD -34	9:20716
9949-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010242	STD -28	9:20633
9956-MS-Pt.1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84010243	STD -38	9:20614
9966-HDR	NTIS, PC A04/MF A01 (GPO Dep.)	DE84010239	STD -66a	9:19957
9974-T	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84009080	STD -34C	9:21314
LA-UR-				
83-2885	NTIS, PC A02/MF A01; 1	DE84001177	MN -32	9:21629
84-52	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006006	MN -20b	9:20303
84-120	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006035	MN -38	9:20607
84-470	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007507	MN -32	9:21630
84-524	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007485	MN -20f	9:21478
84-630	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007285	MN -20g	9:21559
84-631	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007449	MN -20g	9:21479
84-632	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007467	MN -20g	9:21480
84-745	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007481	MN -38	9:20584
84-1104	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009998	MN -37	9:20565
84-1120	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010001	MN -32	9:21631
LBL-				
15382	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009238	MN -95d	9:20387
15878-Rev.	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009243	MN -41	9:20721
16036	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009215	MN -95d	9:20388
17017	NTIS, PC A03; 3 (GPO Dep.)	DE84006769	MN -20a	9:21560
17050	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009224	MN -28	9:20623
17148	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008243	MN -20f	9:21481
17253	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009217	MN -34A	9:20634
17320	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009244	MN -25	9:20516
17380	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009216	MN -4	9:20566
LBL-PUB-				
3038	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84009242	MN -32	9:21632
LIS-Ber.-				
28	NTIS (US Sales Only), PC A08/MF A01; 1	DE84750724	MN -11	9:21134
LUIP-				
8314	NTIS (US Sales Only), PC A02/MF A01	DE84700724	MN -34C	9:21315
LUNFD6/NFFK-				
7037/ 1-11(1983)	*See* LUIP-8314	DE84700724	MN -34C	9:21315
MRC-TSR-				
2601	*See* AD-A-136403/3			9:20357
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4186	*See* PB-84-143098			9:20393
NBSIR-				
82-2582	*See* PB-83-217554		MN -32	9:21633
NE-				
01-84-KWIC-Index	Nuclear Standards Management Center, P.O. Box Y, Oak Ridge, TN 37831 (GPO Dep.)		STD -80	9:20033
NEANDC-				
172-U	NTIS (US Sales Only), PC A03/MF A01	DE84700729	MN -34C	9:21275
NEANDC(E)-				
233-U	NTIS (US Sales Only), PC A04/MF A01	DE84700725	MN -34C	9:21276
242-U(Vol.3)	NTIS (US Sales Only), PC A04/MF A01	DE84700726	MN -34C	9:21406
NEANDC(J)-				
86-U	NTIS (US Sales Only), PC A06/MF A01	DE84700728	MN -34C	9:21354
NIIAR-				
15(530)	NTIS (US Sales Only), PC A02/MF A01	DE84700733	MN -4	9:20546
20(535)	NTIS (US Sales Only), PC A02/MF A01	DE84700749	MN -25	9:20453
NIIEFA-P-A-				
0522	NTIS (US Sales Only), PC A02/MF A01	DE84700777	MN -38	9:20585
NIPER-				
133-PPS-84/ 1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008980	STD -92b	9:19684
NLCO-				
1107-Rev.1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84010109	STD -71	9:20586
NMERDI-				
2-71-4223	NMERDI Information Center, Univ. of New Mexico, 457 Washington, SE, Albuquerque, NM 87108		MN -97e	9:19893
2-71-4638	New Mexico Energy Research and Development Institute Information Center, Univ. of New Mexico, 457 Washington, SE, Suite M, Albuquerque, NM 87108		MN -90	9:19604
NP-				
24478	Research Reports Center, Box 50490, Palo Alto, CA 94303		ND -98E	9:20341
4770177	NTIS (US Sales Only), PC A15/MF A01	DE84770177	MN -11	9:20867
4770178	NTIS (US Sales Only), PC A02; 3	DE84770178	MN -61	9:19910
4770179	NTIS (US Sales Only), PC A03/MF A01	DE84770179	MN -48	9:21135

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4770180	NTIS (US Sales Only), PC A03/MF A01	DE84770180	MN -95d	9:20389
4770182	NTIS (US Sales Only), PC A06/MF A01	DE84770182	MN -48	9:21136
4770183	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770183	MN -13	9:20318
4770184	NTIS (US Sales Only), PC A04/MF A01	DE84770184	MN -4	9:20556
4770185	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770185	MN -13	9:20331
4770186	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770186	MN -13	9:20332
4770187	NTIS (US Sales Only), PC A11/MF A01	DE84770187	MN -48	9:20875
4770188	NTIS (US Sales Only), PC A02/MF A01	DE84770188	MN -62	9:19927
4770189	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770189	MN -13	9:20333
4770190	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770190	MN -11	9:20820
4770191	NTIS (US Sales Only), PC A15/MF A01; 1	DE84770191	MN -13	9:20310
4770192	NTIS (US Sales Only), PC A02/MF A01	DE84770192	MN -13	9:20334
4770193	NTIS (US Sales Only), PC A06/MF A01	DE84770193	MN -13	9:20337
4770194	NTIS (US Sales Only), PC A02; 3	DE84770194	MN -88	9:19656
4900337	NTIS, PC A03/MF A01; 1	DE84900337	MN -98	9:20327
4900386	NTIS, PC A02/MF A01	DE84900386	MN -98E	9:20342
4900387	NTIS, PC A03/MF A01; 1	DE84900387	MN -98C	9:20311
4900390	NTIS, PC A03/MF A01; 1	DE84900390	MN -98B	9:20312
4900506	NTIS, PC A02/MF A01	DE84900506	MN -58	9:19900
4900687	NTIS, PC A02/MF A01; 1	DE84900687	MN -59b	9:19946
4900828	NTIS, PC A10/MF A01; 1	DE84900828	MN -95e	9:20407
4900855	NTIS (US Sales Only), PC A06/MF A01; 1	DE84900855	MN -13	9:20328
4900870	NTIS, PC A05/MF A01; 1	DE84900870	MN -98	9:20345
4900987	NTIS, PC A02/MF A01	DE84900987	MN -60	9:19974
NRL-MR-				
5110	*See* AD-A-134458/9			9:20697
5161	*See* AD-A-134758/2			9:21457
5196	*See* AD-A-134694/9			9:20637
5214	*See* AD-A-134140/3			9:21427
5221	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009387	STD -21	9:21561
NRPB-R-				
131	HMSO, London, price Pound 2.00		ND -41	9:20810
NUREG-				
0525-Rev.8	NTIS, PC A04/MF A01 - GPO $4.50	DE84901012	MN -15	9:19832
0540-Vol.5-No.12	NTIS, PC A23/MF A01; 1 - GPO	DE84900895	MN -2	9:20026
0675-Suppl.22	NTIS, PC A19/MF A01 - GPO $11.00	DE84901017	MN -78	9:20155
0750-Vol.18-No.3	NTIS, PC A20/MF A01 - GPO	DE84900845	MN -2	9:20027
1022-Suppl.1	NTIS, PC A04/MF A01; 1 - GPO $4.50	DE84901029	MN -80	9:20156
1049	NTIS, PC A05/MF A01; 1 - GPO* $4.50	DE84900893	MN -11	9:19819
NUREG/BR-				
0072-Rev.1	NTIS, PC A08/MF A01 - GPO	DE84900847	MN -13	9:21621
NUREG/CR-				
1706	NTIS, PC A13/MF A01; 1 - GPO (GPO Dep.)	DE84009186	MN -78	9:20157
2000-Vol.3-No.2	NTIS, PC A08/MF A01 - GPO (GPO Dep.)	DE84009502	MN -80	9:20158
2331-Vol.3-No.2	NTIS, PC A08/MF A01 - GPO (GPO Dep.)	DE84008056	MN -80	9:20159
2571	*See* EPRI-NP-2377		ND -78	9:20147
3104	NTIS, PC A04/MF A01 - GPO $4.50 (GPO Dep.)	DE84009219	MN -51	9:19820
3359-Vol.4	NTIS, PC A02/MF A01 - GPO (GPO Dep.)	DE84008285	MN -79p	9:20160
3389	NTIS, PC A03/MF A01 - GPO (GPO Dep.)	DE84007581	MN -70	9:19821
3560	NTIS PC E05/MF A01 - GPO $5.50 (GPO Dep.)	DE84009218	MN -70	9:19822
3561	NTIS (US Sales Only), PC A07/MF A01 - GPO $5.00 (GPO Dep.)	DE84007291	MN -78	9:20016
3603	NTIS, PC A03/MF A01; 1 - GPO (GPO Dep.)	DE84009542	MN -79p	9:20082
3605	NTIS, PC A04/MF A01; 1 - GPO $4.25	DE84900916	MN -80	9:20032
3621	NTIS, PC A07/MF A01 - GPO $5.50 (GPO Dep.)	DE84009496	MN -80	9:20161
3622	NTIS, PC A04/MF A01 - GPO (GPO Dep.)	DE84006893	MN -78	9:20162
3628	NTIS, PC A05/MF A01 - GPO (GPO Dep.)	DE84009543	MN -80	9:20163
3667	NTIS, PC A04/MF A01 - GPO (GPO Dep.)	DE84009227	MN -80	9:20323
3699	NTIS, PC A14/MF A01 - GPO* $7.50	DE84901014	MN -70	9:19780
ON-				
01/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701054	MN -34B	9:21175
03/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701009	MN -34D	9:21440
ORAU/IEA-				
83-13(M)	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009509	MN -80	9:20324
ORNL-				
5782	NTIS, PC A22/MF A01; 1 (GPO Dep.)	DE84009359	STD -90d	9:19626
5978	*See* NUREG/CR-3389	DE84007581	MN -70	9:19821
6029	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009451	STD -2	9:21643
ORNL/CON-				
141	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008223	MN -95d	9:20390
149	NTIS, PC A04/MF A01 (GPO Dep.)	DE84010240	STD -95d	9:20391
ORNL/FMP-				
84/ 1	NTIS, PC A22/MF A-01; 1 (GPO Dep.)	DE84009480	MN -90	9:20454
ORNL/NSIC-				
200-Vol.3-No.2	*See* NUREG/CR-2000-Vol.3-No.2	DE84009502	MN -80	9:20158
ORNL/Sub-				
81/ 24707/ 2	NTIS, PC A19/MF A01; 1 (GPO Dep.)	DE84010163	MN -90d	9:19886
81-61623/ 1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009110	STD -97b	9:20615
81/ 70519/ 1	NTIS, PC A06/MF A01 (GPO Dep.)	DE84009483	STD -97b	9:20587
ORNL/TM-				
8841	*See* NUREG/CR-3622	DE84006893	MN -78	9:20162
8960	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009117	MN -70	9:19781
8991	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009468	MN -70	9:19823
8994	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009111	STD -20c	9:21562
9034	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009452	STD -20f	9:21482

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ORNL-tr-				
5071	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006620	MN -4	9:20495
5082	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006968	MN -25	9:20498
5086	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84009424	MN -79d	9:20035
ORO-				
5126-207	*See* DOE/ER/05126-207	DE84008018	MN -34D	9:21358
OTA-M-				
82-Vol.1	NTIS, PC A12/MF A01; 1	DE84900018	MN -11	9:20319
82-Vol.2	NTIS, PC A14/MF A01; 1	DE84900017	MN -11	9:20320
PA-TR-				
2700-VOL-10	*See* AD-A-134347/4			9:20706
PATENTS-US-	(US: Commissioner of Patents, Washington, D.C. 20231, USA, $1.00 per copy. Government Patent Applications available from NTIS)			
A 6-229,023		DE82004461	MN -34	9:20602
A 6-442,065		DE84005944	MN -37	9:20704
PB-				
83-217554	NTIS, PC A08; 3		MN -32	9:21633
83-223586	NTIS, PC A11/MF A01		MN -64	9:19936
84-122290	NTIS, PC A09/MF A01			9:20398
84-122985	NTIS, PC A14/MF A01			9:20821
84-123124	NTIS, PC A02/MF A01			9:20751
84-123637	NTIS, PC A05/MF A01			9:20759
84-124775	NTIS, PC A02/MF A01			9:20588
84-126770	NTIS, PC A08/MF A01			9:20822
84-126978	NTIS, PC A04/MF A01			9:20728
84-127752	NTIS, PC A03/MF A01			9:20729
84-136514	NTIS PC E05/MF E01			9:19782
84-136563	NTIS PC E07/MF E07			9:20307
84-137272	NTIS PC E04/MF E04			9:20335
84-137280	NTIS PC E05/MF E05			9:19911
84-137306	NTIS PC E06/MF E06			9:19912
84-137330	NTIS PC E12/MF E12			9:19948
84-137348	NTIS PC E13/MF E13			9:19949
84-138270	NTIS PC E04/MF E04			9:19913
84-138932	NTIS PC E08/MF E08			9:19914
84-140516	NTIS, PC A06/MF A01			9:19894
84-141720	NTIS PC E05/MF E05			9:20392
84-143015	NTIS PC E04/MF E04			9:20408
84-143098	NTIS, PC A04/MF A01			9:20393
84-143841	NTIS PC E04/MF E04			9:20409
84-144435	NTIS PC E04/MF E04			9:20394
84-144732	NTIS PC E04/MF E04			9:20410
84-148071	NTIS, PC A07/MF A01			9:20395
84-148089	NTIS, PC A06/MF A01			9:20421
84-148097	NTIS, PC A08/MF A01			9:20411
84-153212	NTIS, PC A11/MF A01			9:20620
PEL-				
283	NTIS (US Sales Only), PC A02/MF A01	DE84700771	MN -41	9:20752
PERG-RR-				
9	British Library Lending Division, Boston Spa, Wetherby, West Yorks., LS23 7BQ		ND -41	9:19824
PNC-G-				
065-82-01	NTIS (US Sales Only), PC A11/MF A01	DE84780150	MN -80	9:20022
PNL-				
3594-Rev.4	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84008529	MN -70	9:19783
4583	*See* NUREG/CR-3104	DE84009219	MN -51	9:19820
4695	*See* NUREG/CR-3561	DE84007291	MN -78	9:20016
4832	*See* NUREG/CR-3621	DE84009496	MN -80	9:20161
4840	*See* DOE/UMT-0214	DE84010103	MN -70	9:19778
4850	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84009962	MN -95f	9:20412
4852	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84010236	MN -95f	9:20413
4855	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84010235	MN -95f	9:20414
4904	*See* NUREG/CR-3560	DE84009218	MN -70	9:19822
4910	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84008525	MN -95f	9:20415
4945	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008905	MN -70	9:19784
5035	NTIS, PC A11/MF A01 (GPO Dep.)	DE84010114	MN -11	9:20753
5042	NTIS, PC A03/MF A01 (GPO Dep.)	DE84010241	MN -66d	9:19964
5061	NTIS, PC A07/MF A01 (GPO Dep.)	DE84008904	MN -95f	9:20416
PNL-SA-				
10247	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008305	MN -41	9:21116
10970	*See* HEDL-SA-2892-FP	DE84003952	MN -79	9:19727
11878	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006580	MN -61D	9:19887
11890	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008303	MN -41	9:20677
PPPL-				
2060	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009354	STD -20f	9:21483
2075	NTIS, PC A03/MF A01 (GPO Dep.)	DE84010232	STD -20c	9:21563
2087	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009353	STD -20f	9:21484
2088	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010233	STD -20g	9:21485
2089	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009355	STD -20g	9:21486
2091	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010227	STD -20f	9:21487
2092	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009550	STD -20f	9:21564
2093	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009551	STD -20f	9:21488
PUC-TN-				
04/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84701010	MN -34D	9:21424

Report No.	Availability	Order No.	Distribution Category	Abstract No.
PWAC-				
176-Rev.	NTIS, PC A03; 3 (GPO Dep.)	DE84007055	MN -33	9:20138
R-				
83-19892	*See* PB-84-148071			9:20395
83-20022	*See* PB-84-148089			9:20421
83-20289	*See* PB-84-148097			9:20411
RFP-				
3583	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007979	STD -41	9:20812
3610	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84009405	MN -25	9:20455
RFP-Trans-				
424	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009460	MN -4	9:20486
RHO-BW-SA-				
302AP	NTIS, PC A02/MF A01 (GPO Dep.)	DE83014644	MN -70	9:19785
RL-				
83-072	NTIS (US Sales Only), PC A02/MF A01	DE84701076	MN -46	9:21407
RM-				
80-ISI101	*See* AD-A-134726/9			9:20714
SAI-				
83/ 1013-APPAT-20	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010104	STD -20g	9:21565
SAND-				
80-7155	NTIS, PC A04/MF A01 (GPO Dep.)	DE84010078	MN -11	9:19829
82-1774	NTIS, PC A06/MF A01 (GPO Dep.)	DE84009506	STD -70	9:19786
82-1971C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006341	MN -38	9:21153
82-7068/ 2	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84006505	MN -62	9:19928
82-7147	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84008825	STD -63a	9:19923
82-7149	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009505	STD -63a	9:19924
83-0347	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010106	MN -94e	9:19685
83-1288	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009963	MN -45	9:20707
83-1460	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84009508	STD -91	9:19700
83-1724	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010083	MN -4	9:20517
83-1854C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006485	MN -80	9:20499
83-1889C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008293	MN -38	9:20579
83-1909C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007888	MN -60	9:19975
83-1929	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009500	MN -45	9:20708
83-1932C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009464	MN -63	9:19915
83-2017C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006723	MN -80	9:20500
83-2018C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006721	MN -80	9:20164
83-2019C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006713	MN -80	9:20501
83-2085C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006966	MN -80	9:20502
83-2431	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008526	MN -13	9:21634
83-2448C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009063	MN -92a	9:19691
83-2469C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009095	MN -91	9:19686
83-2470C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007575	MN -92a	9:19692
83-2507C	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009489	MN -70	9:19787
83-2564C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010148	MN -21	9:21566
83-7023	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010108	MN -63c	9:19916
83-8011	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84009549	MN -32	9:20590
84-0317C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006486	MN -38	9:21450
84-0413	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010107	MN -32	9:21451
84-0543C	NTIS, PC A02 (GPO Dep.)	DE84008335	MN -92a	9:19687
84-0648C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009445	MN -70	9:19788
84-0668C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009954	MN -37	9:20700
84-0704C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009491	MN -70	9:19789
84-7109	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009507	STD -66c	9:19958
SERI/SP-				
254-1788	NTIS, PC A10/MF A01 (GPO Dep.)	DE84010018	MN -95d	9:20396
281-2154	NTIS, PC A02/MF A01 (GPO Dep.)	DE84000084	STD -61	9:19917
290-1448	NTIS, PC A04/MF A01 (GPO Dep.)	DE84007673	MN -63	9:19918
SLAC-PUB-				
3288	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006776	MN -34D	9:21223
3298	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007804	MN -34D	9:20678
3299	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008203	MN -34D	9:20679
SOLAR/1118-				
83/ 14	NTIS, PC A03/MF A01 (GPO Dep.)	DE84004357	STD -59	9:19947
SOU-				
1983-26	NTIS (US Sales Only), PC A07/MF A01	DE84700759	MN -23	9:21117
SRC-CR-				
81-75-Vol.2	*See* DOE/ET/27125-T4-Vol.2	DE84008037	MN -66a	9:19963
83-40-Vol.3	*See* DOE/ET/27125-T2-Vol.3	DE84008042	MN -66a	9:19962
83-43-Vol.6	*See* DOE/ET/27125-T2-Vol.6	DE84008039	MN -66a	9:19960
SRD-R-				
249	NTIS (US Sales Only), PC A02/MF A01	DE84700750	MN -25	9:20518
SREL-				
15	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008574	MN -11	9:20866
STMPO-				
606	*See* DOE/SF/10501-306	DE84006965	MN -62	9:19899
TES-				
32066-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010252	MN -33	9:19862
32066-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010247	MN -33	9:19863
32066-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010248	MN -33	9:19864
32066-4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010249	MN -33	9:19865
32066-5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010245	MN -33	9:19866
32066-7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010246	MN -33	9:19867
32066-8	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009456	MN -33	9:19868

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TID-				
22537	*See* ABCC-2-65	DE84008103	MN -48	9:20945
23420	*See* ABCC-20-66	DE84008099	MN -48	9:21035
TIM-				
66	*See* FXM-909	DE84007627	MN -33	9:20131
75-Suppl.1	*See* FXM-922-Suppl.1	DE84007614	MN -33	9:21626
94	*See* FXM-978	DE84007628	MN -33	9:20133
106	*See* FXM-1002	DE84007631	MN -33	9:20134
110	*See* FXM-1011	DE84007635	MN -33	9:20135
111	*See* FXM-1014	DE84007634	MN -33	9:20136
368	NTIS, PC A02; 3 (GPO Dep.)	DE84009912	MN -33	9:20456
689	NTIS, PC A02; 3 (GPO Dep.)	DE84009909	MN -33	9:20549
694	NTIS, PC A02; 3 (GPO Dep.)	DE84009908	MN -33	9:20139
706	NTIS, PC A02; 3 (GPO Dep.)	DE84009792	MN -33	9:20140
713	NTIS, PC A02; 3 (GPO Dep.)	DE84009798	MN -33	9:20141
716	NTIS, PC A02; 3 (GPO Dep.)	DE84009796	MN -33	9:20142
TM-				
61	*See* PB-84-144732			9:20410
64	*See* PB-84-143015			9:20408
71	*See* PB-84-143841			9:20409
76	*See* PB-84-144435			9:20394
80	*See* PB-84-141720			9:20392
TOP-				
8-2-064	*See* AD-A-134611/3			9:20672
TR-				
2	*See* AD-A-134837/4			9:20503
0083(3940-01) -2	*See* AD-A-134318/5			9:21160
TRI-PP-				
82-5	NTIS (US Sales Only), PC A02/MF A01	DE84701071	MN -34D	9:21233
82-8	NTIS (US Sales Only), PC A02/MF A01	DE84701072	MN -34D	9:21234
82-11	NTIS (US Sales Only), PC A03/MF A01	DE84701088	MN -34C	9:21235
82-12	NTIS (US Sales Only), PC A02/MF A01	DE84701028	MN -34D	9:21248
82-13	NTIS (US Sales Only), PC A02/MF A01	DE84701089	MN -34C	9:21292
82-14	NTIS (US Sales Only), PC A02/MF A01	DE84701070	MN -34D	9:21236
83-119	NTIS (US Sales Only), PC A02/MF A01; 1	DE84900953	MN -28	9:20661
TRITA-EPP-				
83-01	NTIS (US Sales Only), PC A03/MF A01	DE84700756	MN -34B	9:21182
TVA/ONR/WRF-				
83/ 14(b)	NTIS MF A01; 2	DE84900345	MN -11	9:20865
UCID-				
18756-Rev.2	NTIS, PC A06/MF A01 (GPO Dep.)	DE84010100	MN -32	9:21635
19938	NTIS, PC A04/MF A01; 3 (GPO Dep.)	DE84007092	MN -11	9:20717
19975	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84008827	MN -20	9:21567
19995	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009658	MN -4	9:20718
20007	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84006783	MN -32	9:20701
20033	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84009347	MN -11	9:20719
20034	NTIS, PC A03/MF A01 (GPO Dep.)	DE84010101	MN -38	9:20591
20035	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008536	MN -32	9:21636
20036	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006573	MN -80	9:19993
20038	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008019	MN -80	9:20052
20040	NTIS, PC A02; 3 (GPO Dep.)	DE84008818	MN -20c	9:21568
20041	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009662	MN -32	9:21452
20043	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008532	MN -21	9:21569
20044	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009661	MN -21	9:21570
20048	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008531	MN -20b	9:21571
30198	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009533	MN -32	9:21637
UCRL-				
15216	*See* NUREG/CR-1706	DE84009186	MN -78	9:20157
15594	NTIS, PC A06/MF A01 (GPO Dep.)	DE84009530	MN -11	9:21152
50051-83-2	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008820	STD -20	9:21572
78910	NTIS, PC A02/MF A01		MN -32	9:21638
86249	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009540	MN -78	9:20165
88213	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009536	MN -21	9:21573
88391	NTIS, PC A02/MF A01; 1	DE84002458	MN -41	9:21415
88392	NTIS, PC A04/MF A01; 1	DE83016575	MN -37	9:20680
88450	NTIS, PC A02/MF A01	DE84002720	MN -11	9:20813
89119	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007761	MN -21	9:21574
89230	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009087	MN -20	9:21575
89233	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009105	MN -20	9:21489
89240	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009108	MN -20	9:21576
89241	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009085	MN -20	9:21577
89242	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009538	MN -20a	9:21578
89245	NTIS, PC A02; 3 (GPO Dep.)	DE84009086	MN -20	9:21579
89274	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008298	MN -20d	9:21580
89291	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008059	MN -21	9:21581
89569	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008326	MN -21	9:21582
89704	NTIS, PC A02/MF A01 (GPO Dep.)	DE84001004	MN -32	9:21641
89755	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008297	MN -32	9:21639
89778	NTIS, PC A02/MF A01	DE83017837	MN -11	9:20863
89824	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009539	MN -4	9:19847
89846	NTIS MF A01; 2 (GPO Dep.)	DE84002782	MN -45	9:20709
89868	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009857	MN -34A	9:21583
89896	NTIS, PC A02/MF A01	DE84002009	MN -11	9:20681
90466	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008329	MN -25	9:20457

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UFRJ-IF-				
03/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701011	MN -34D	9:21257
04/ 83	NTIS (US Sales Only), PC A03/MF A01	DE84701012	MN -34D	9:21441
05/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701013	MN -34D	9:21442
06/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701014	MN -34D	9:21443
07/ 83	NTIS (US Sales Only), PC A03/MF A01	DE84701042	MN -34A	9:20519
08/ 83	NTIS (US Sales Only), PC A03/MF A01	DE84701043	MN -34A	9:20520
10/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701044	MN -34A	9:20521
11/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701015	MN -34D	9:21258
12/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701016	MN -34D	9:21259
13/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84701085	MN -34C	9:21304
13/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701017	MN -34D	9:21260
14/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701018	MN -34D	9:21444
16/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701061	MN -34B	9:21176
17/ 83	NTIS (US Sales Only), PC A02/MF A01	DE84701019	MN -34D	9:21261
UILU-ENG-				
83-1734	*See* UIUCDCS-R-83-1154	DE84008487	MN -32	9:21425
84-1706	*See* UIUCDCS-R-84-1151	DE84010028	MN -32	9:21640
UIUCDCS-R-				
83-1154	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008487	MN -32	9:21425
84-1151	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84010028	MN -32	9:21640
USGS-CIRC-				
892	NTIS, PC A05/MF A01 (GPO Dep.)	DE84007193	MN -66b	9:19950
USGS-OFR-				
78-1008	NTIS, PC A17; 3	DE83902372	MN -51	9:19722
79-1140	Geological Survey, Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225		MN -88	9:19649
79-1173	Geological Survey, Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225		MN -88	9:19650
79-1178	USGS Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225; 1		MN -51	9:19723
82-281	Geological Survey, Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225		MN -90	9:19651
82-468-A	S; 3 (GPO Dep.)	DE84005038	MN -64	9:19937
82-468B	NTIS, PC A13; 3 (GPO Dep.)	DE84005041	MN -64	9:19938
82-1051	USGS-Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225		MN -91	9:19719
83-535	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84009032	STD -70	9:21150
83-855	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84009090	STD -70	9:21151
83-856	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009351	MN -70	9:19790
84-063	NTIS, PC A04/MF A01 (GPO Dep.)	DE84010085	STD -70	9:19791
UTSI-				
82-18	*See* DOE/ET/10815-74	DE84008052	STD -90g	9:20348
WAOENG-				
80-21	Washington State Energy Office, 400 E. Union, Olympia, WA 98504		MN -98E	9:20343
WINCO-				
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TD Chad
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TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Vietnam
VE Venezuela
VS Republic of Vietnam

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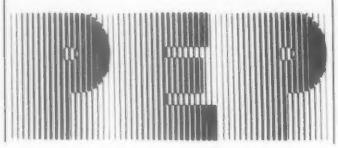

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